TEKTRONIX®

148-M

148-M INSERTION TEST SIGNAL GENERATOR

INSTRUCTION MANUAL

Tektronix, Inc.
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Beaverton, Oregon 97077

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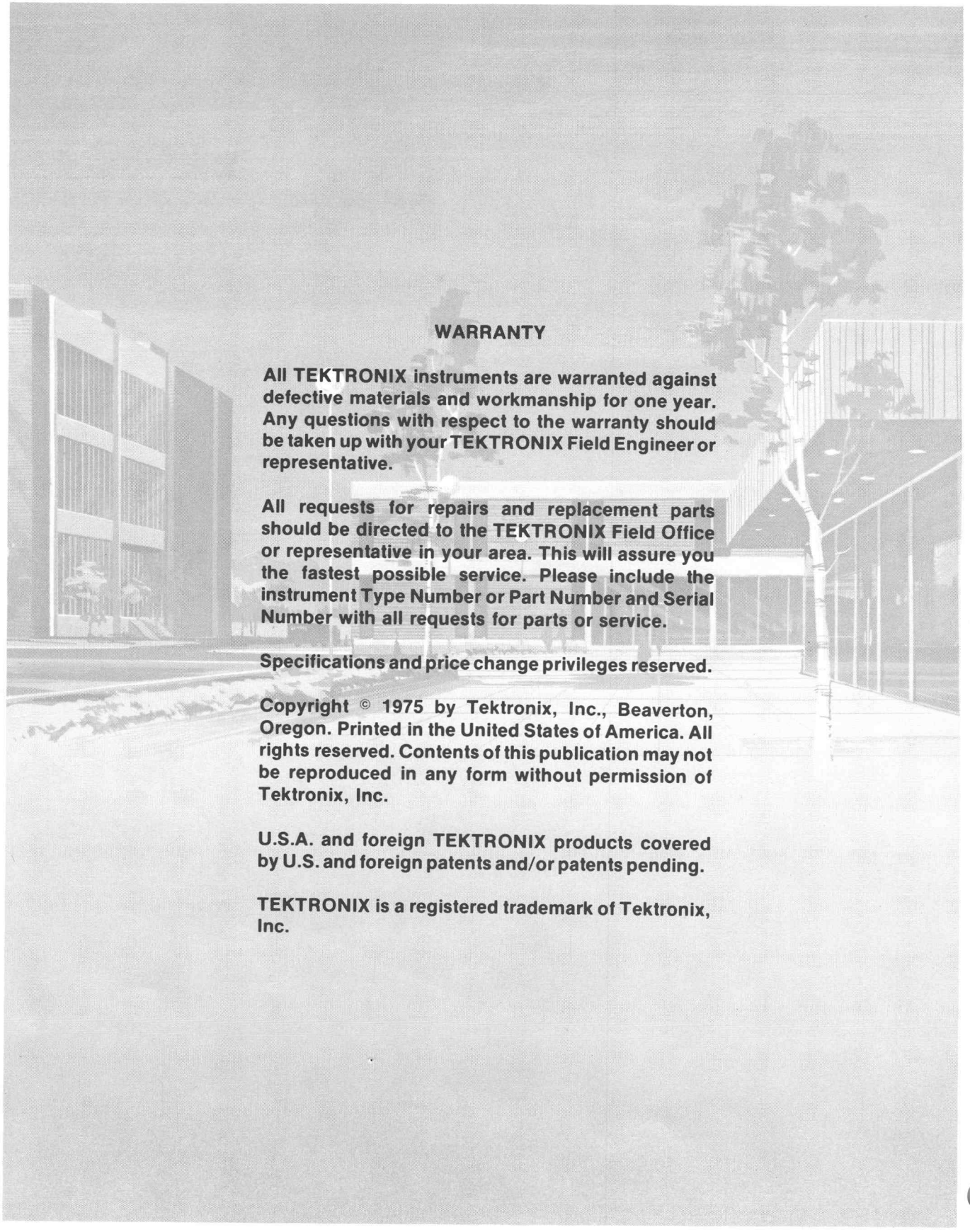

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

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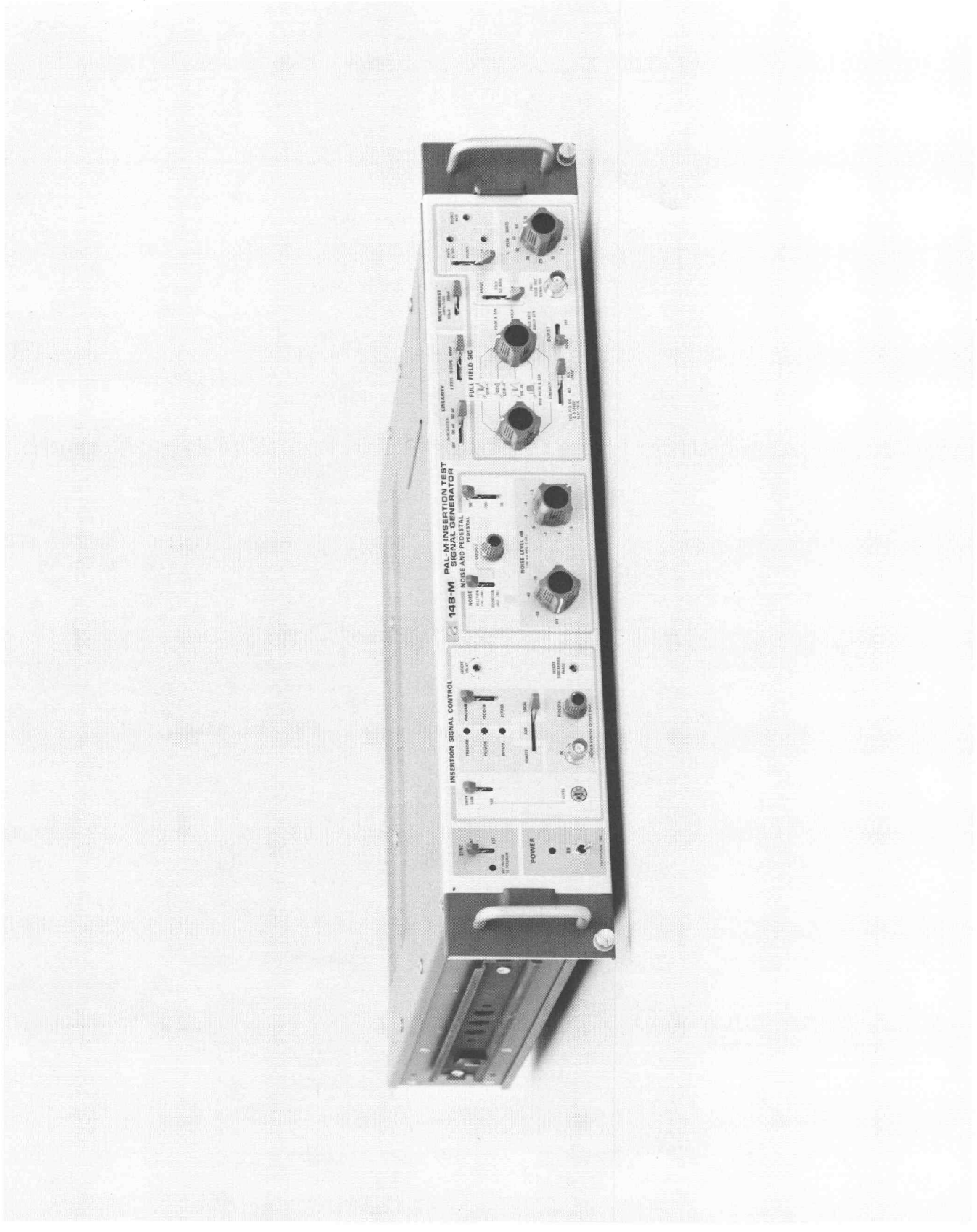


Fig. 1-1. The 148-M PAL-M Insertion Test Signal Generator.

SECTION 1

General Information

The 148-M is a PAL (Phase Alternate Line) television test signal generator capable of supplying several test signals commonly used for test and measurement of video transmission systems or discrete parts of the system. The generated signals are available as full-field composite video test signals on one output, and as Vertical Interval Test Signals (VITS) inserted into the vertical blanking interval on an incoming composite video signal, appearing in combined form on another output.

All time locations of test signals, as to position within both the line and field, are derived by digital counting from a master oscillator, which is locked to the incoming synchronizing pulses. The 148-M may be used in conjuction with the TEKTRONIX 145-M to provide standard test signals with Gen-Locked operation.

Several different test signals may be inserted on successive lines during the vertical blanking interval, providing a simultaneous check of the complete television transmission system.

A Preview mode of operation permits observing the signal with insertion signals added before adding to the program signal.

[1]**Synchronization of signals in both frequency and phase.**

In the event of power failure, or the actuation of a remote bypass switch, a relay switch routes the program signal around the instrument, bypassing all circuitry and thus providing fail-safe protection.

Safety Considerations

The instrument is intended to be operated from a single-phase power source which has one of its current-carrying conductors (neutral) at or near ground (earth) potential. Operation from other power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on a multi-phase system) is not recommended, as only the Line Conductor has over-current (fuse) protection within the instrument.

ELECTRICAL CHARACTERISTICS

Performance Conditions

Characteristics and their Performance Requirements described in this section are valid over the stated environmental range, for instruments calibrated at an ambient temperature between +20° C and +30° C. Instrument warmup of 5 minutes is required.

TABLE 1-1

Insertion Control System

Characteristics	Performance Requirements	Supplemental Information
Signal Input Level		
Unity Level	±0.5% of Unity Gain	
VAR	1 V peak-to-peak variable within 3 dB	
PROGRAM Input Impedance	75 Ω nominal	
PROGRAM Input Return Loss		
POWER ON	At least 46 dB to 5 MHz	
POWER OFF or BYPASS	At least 40 dB to 5 MHz	
Output Impedance (All)	75 Ω nominal	
Output Return Loss (All)	At least 36 dB to 5 MHz	

TABLE 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Output Blanking DC Level (All)	0 volts within 50 mV	
Isolation (All)	At least 46 dB to 1 MHz At least 34 dB to 3.58 MHz	
Inserted Signal Amplitude	Within 1% of nominal input amplitude	
Amplitude Ratio		
2T Pulse to Bar	100% ±0.5%	
Mod Sin^2 Pulse	100% ±0.5%	Chrominance to Luminance
Waveform Tilt		
Line Tilt	0.25% or less	
Field Rate Square-Wave	0.5% or less	
Differential Phase (10-90 APL, Standard Input)		
PROGRAM OUTPUT	0.15° or less	0.3° or less at +3 dB
PREVIEW OUTPUT	0.3° or less	
Differential Gain (10-90 APL, Standard Input)		
PROGRAM OUTPUT	0.2% or less	0.4% or less at +3 dB
PREVIEW OUTPUT	0.4% or less	
Luminance Amplitude Non-Linearity	0.25% or less	Unmodulated Staircase
Random Noise Output on PROGRAM OUTPUT	At least 75 dB (RMS) down	Using Weighted and Low Pass Filters (4.2 MHz)
Residual Subcarrier on Non-Inserted Lines	At least 60 dB down	3.58 MHz Bandpass Filter
Hum or Transients on Non-Inserted Lines	At least 60 dB down	Using Weighted and Low Pass Filters (4.2 MHz)
Spurious Signals During:		
Blanking	At least 40 dB down	Low Pass (4.2 MHz)
Active Picture, VITS	At least 60 dB down	Low Pass (4.2 MHz)

TABLE 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Signal Attenuation In "Delete" Mode		
2T Pulse	At least 70 dB down	Low Pass (4.2 MHz)
Subcarrier (Staircase)	At least 60 dB down	Low Pass (4.2 MHz)
Crosstalk Into Program Channel from Internal Signal		
2T Pulse	At least 70 dB down	Low Pass (4.2 MHz)
Subcarrier (Staircase)	At least 60 dB down	Low Pass (4.2 MHz)
INSERT DELAY Range	At least ±0.5 μs (1 μs total)	
Time Jitter		5 ns or less
Frequency Response	±1% to 5 MHz	
Unwanted Pedestal at Time of VITS Insertion	5 mV or less	

TABLE 1-2

Test Signals

Characteristics	Performance Requirements	Supplemental Information
CCIR-I		
Bar		
Amplitude	700 mV ±1%	
Risetime	230 ns ±15% (2T); 115 ns ±15% (T)	Determined by 2T and T Sin^2 Filters
Pulse		
Pulse to Bar Ratio	100% ±0.5%	
HAD	250 ns ±15% (2T); 125 ns ±15% (T)	Determined by 2T and T Sin^2 Filters
Ringing Amplitude	0.5% or less	
Ringing Duration		2 cycles or less (Determined)
Modulated Sin^2 Pulse	12.5 T	Other pulses available by plug-in filter
Amplitude of Luminance Component	350 mV ±2%	

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
Amplitude Difference of Peak Chrominance to Peak Luminance	3.5 mV or less	
Chrominance to Luminance Delay	10 ns or less	Measured from baseline
HAD	1.57 μs ±50 ns	
Modulated 5-Step Staircase		
Luminance		
Step Amplitude	140 mV ±1%	700 mV ±1% total
Risetime	230 ns ±15%	Determined by 2T Sin^2 Filter
Chrominance		
Amplitude	280 mV ±1% (peak-to-peak)	
Risetime	400 ns ±25 ns	
Phase of Chrominance Components	180°, ±5°, from the +U axis	
Timing	See Fig. 1-2	
CCIR-II		
Pedestal Amplitude		
700 mV	700 mV ±1%	
Multiburst Amplitude		
700 mV	700 mV ±1%	
350 mV	350 mV ±1%	Top at 525 mV, Bottom at 175 mV
Average Level	350 mV ±5 mV	
Burst Frequencies	0.5 MHz ±3% 1.0 MHz ±3% 2.0 MHz ±3% 3.0 MHz ±3% 3.575 MHz ±3% 4.2 MHz +0% and −2%	
Burst Harmonic Content	−40 dB or less	

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
Burst Timing	Each burst starts at 0° and consists of a whole number of cycles.	
Modulated Pedestal		
First Chroma Level	140 mV peak-to-peak ±1%	
Second Chroma Level	280 mV peak-to-peak ±1%	
Third Chroma Level	560 mV peak-to-peak ±1%	
Average Level	350 mV ±1%	
Phase	180°, ±5°, from the +U axis	
Envelope Rise & Fall Times	400 ns ±25 ns	
Timing	See Fig. 1-2	
SIG-III		
Bar		
Amplitude	700 mV ±1%	
Risetime	230 ns ±15% (2T); 115 ns ±15% (T)	Determined by 2T and T Sin^2 Filters
Pulse		
Pulse to Bar Ratio	100% ±0.5%	
HAD	250 ns ±15% (2T); 125 ns ±15% (T)	Determined by 2T and T Sin^2 Filters
Ringing Amplitude	0.5% or less	
Ringing Duration		2 cycles or less (determined)
Modulated Sin^2 Pulse	12.5 T	Other pulses available by plug-in filter
Amplitude of Luminance Component	350 mV ±2%	
Amplitude Difference of Peak Chrominance to Peak Luminance	3.5 mV or less	
Chrominance to Luminance Delay	10 ns or less	Measured from baseline
Duration of 12.5 T Pulse	1.57 μs ±50 ns	

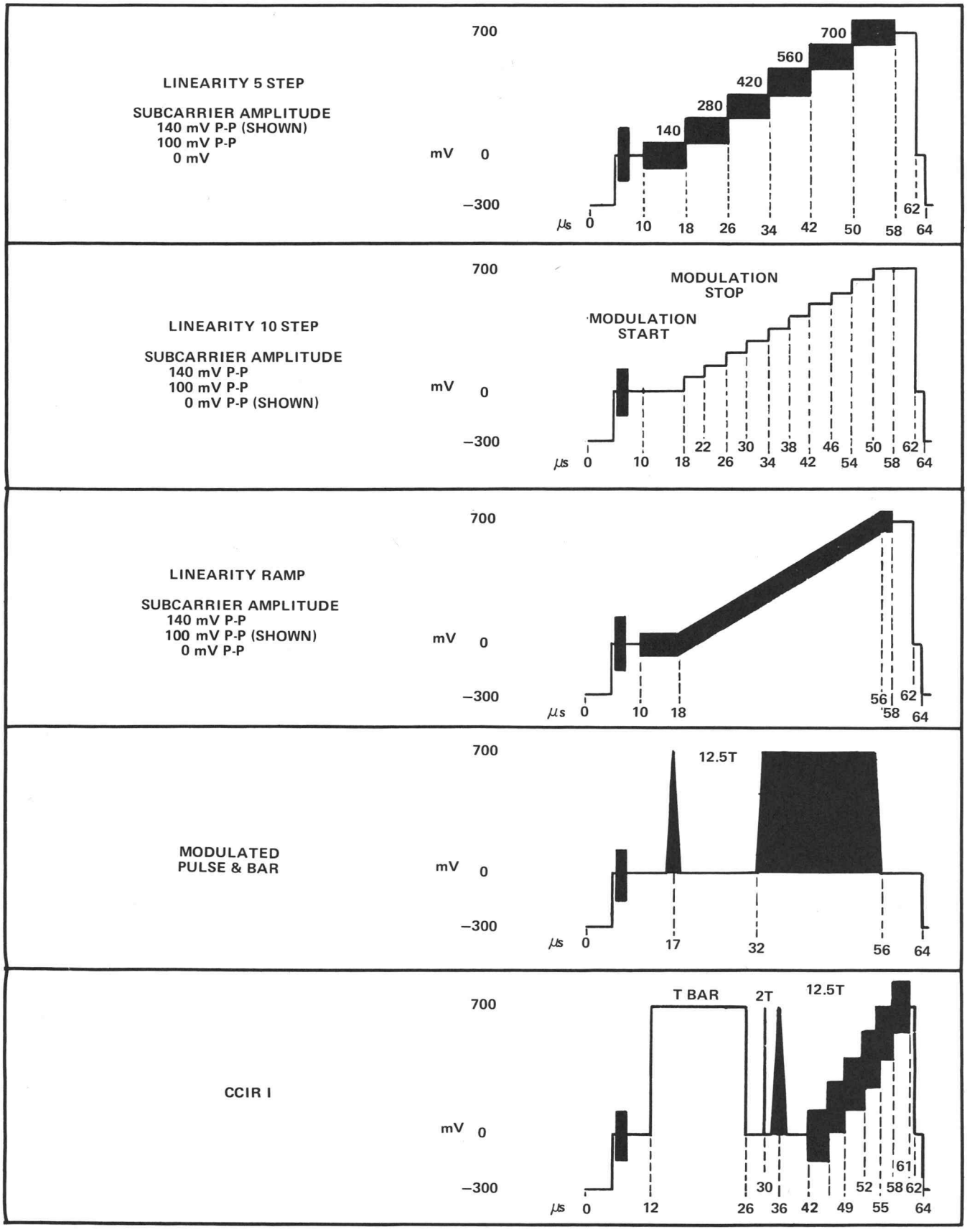
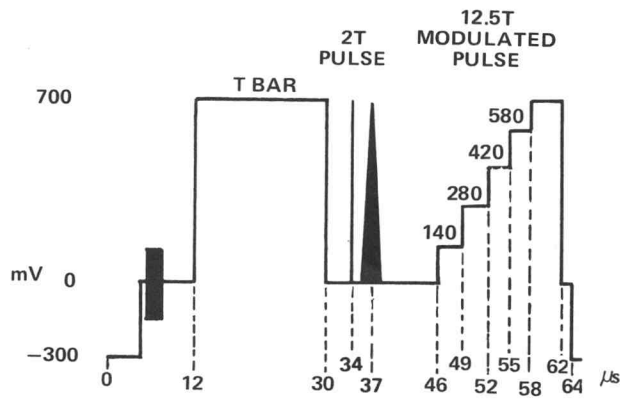
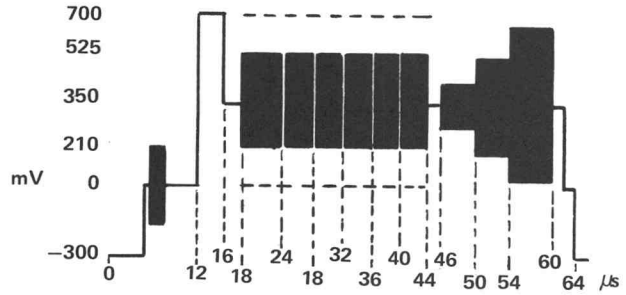


Fig. 1-2. Test signal output timing details.

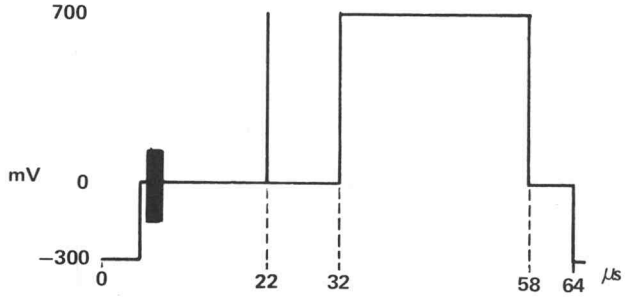


SIG. III



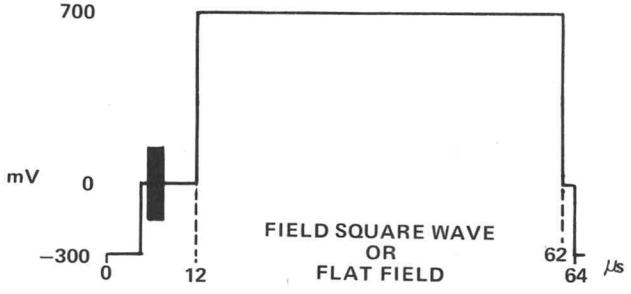
MULTIBURST: 700 mV
350 mV

CCIR II



PULSE & BAR

NOTE:
BAR PORTION OF PULSE & BAR SIGNAL BETWEEN LINES 63 AND 215 ONLY.



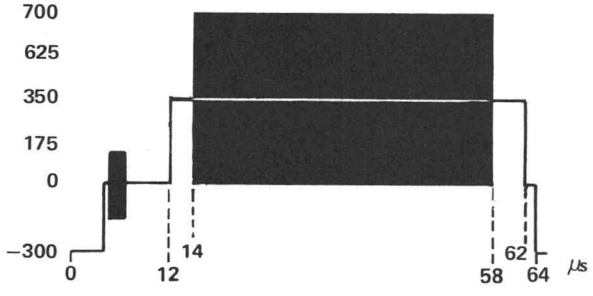
Notes:

1: BLACK (0 mV) BEFORE LINE 74 and AFTER LINE 206 FOR FIELD SQUARE WAVE.

2: VARIABLE AMPLITUDES: 0, 70, 140, 210, 350, 420, 490, 560, 630, or 700 mV.

3: PRESET BLACK: 0 TO 105 mV.

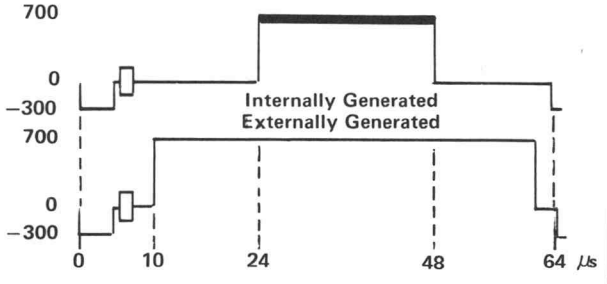
4: PRESET WHITE: 595 TO 700 mV.



FIELD RATE SWEEP GENERATOR

MODULATION AMPLITUDES:
700 mV P-P or 350 mV P-P

NOISE AT PREVIEW OUT IN INSERTION MODE



NOISE AT PREVIEW & FULL FIELD OUTPUTS IN DELETION MODE

NOTE: NOISE TEST SIGNAL AVAILABLE ON VITS LINES ONLY.

Fig. 1-2 (cont). Test signal output timing details.

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
Residual Subcarrier on Insertion Line	3.5 mV or less	
Harmonic Content of Subcarrier	−40 dB or greater	
Phase Insertion and Full-Field	180°, ±5°, from the +U axis	
5-Step Luminance Staircase		Programmable for Ramp
Step Amplitude	140 mV ±1%	700 mV ±1% Total
Risetime	230 ns ±15%	Determined by 2T Sin^2 Filter
Timing	See Fig. 1-2	
MOD PULSE & BAR		
Modulated Sin^2 Pulse	12.5 T	Other pulses available by plug-in filter
Amplitude of Luminance Component	350 mV ±2%	
Amplitude Difference of Peak Chrominance to Peak Luminance	3.5 mV or less	
Chrominance to Luminance Delay	10 ns or less	
HAD of 12.5 T Pulse	1.57 μs ±50 ns	
Modulated Bar		
Amplitude of Chrominance	700 mV peak-to-peak ±1%	
Amplitude of Luminance	350 mV ±2%	
Risetime	1.41 μs, ±.05 μs	12.5 T
Residual Subcarrier On Insertion Line	3.5 mV or less	
Harmonic Content of Subcarrier	−40 dB or greater	
Phase Insertion and Full-Field	180°, ±5°, from the +U axis	
Timing	See Fig. 1-2	

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
LINEARITY		
Luminance		
Staircase Signal		
Step Amplitude		
5 Step	140 mV ±1%	700 mV ±1% Total
10 Step	70 mV ±1%	700 mV ±1% Total
Risetime (All Identical)	230 ns ±15%	Determined by 2T Sin^2 Filter
Ramp Amplitude	700 mV ±1%	
Chrominance		
OFF	No Chrominance	
100 mV	100 mV ±1% peak-to-peak	
140 mV	140 mV ±1% peak-to-peak	
Inherent Differential Gain	0.5% or less	
Inherent Differential Phase	0.2° or less	
Phase	180°, ±5°, from the +U axis	
Timing	See Fig. 1-2	Waveform transitions determined by characteristic instants
FIELD RATE SWEEP GEN		
Swept Frequency Limits	Less than 200 kHz to more than 6 MHz in one field	
Markers	Modulation blanked for 2 line periods 7 times per field (or 3 times per field by plug-jumper)	Swept Frequency is adjusted for approximately 1 MHz per marker
Modulation Amplitude	700 mV (or 350 mV by MULTI-BURST AMPLITUDE switch) ±1% to 5 MHz	
Pedestal Amplitude	350 mV ±5 mV	
Timing	See Fig. 1-2	
FLAT FIELD		
PRESET		
WHITE	85% to 100% of Peak White	Adjustable
BLACK	0% to 15% of Peak White	Adjustable
BOUNCE	Automatic Bounce between WHITE and BLACK	

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
RATE	Less than 1 sec to more than 10 sec	Adjustable
VAR APL	11 levels, each within 0.5% of nominal levels	
FIELD SQUARE-WAVE		
Amplitude	700 mV ±1%	
Lines at WHITE	Lines 74 through 206; Lines 337 through 469	50% Duty Cycle
Lines at Blanking	All other lines	
Risetime	230 ns ±15%	Determined by 2T Sin^2 Filter
Timing	See Fig. 1-2	
PULSE & BAR		
Pulse		
Pulse to Bar Ratio	100% ±0.5%	
HAD	250 ns ±15% (2T); 125 ns ±15% (T)	Determined by 2T and T Sin^2 Filters
Ringing Amplitude	0.5% or less	
Ringing Duration		2 cycles or less (determined)
Bar		
Amplitude	700 mV ±1%	
Risetime	230 ns ±15%	Determined by 2T Sin^2 Filter
Duration	26 μs/line X 152 lines	Lines 63 through 215; lines 326 through 478
Timing	See Fig. 1-2	
NOISE		Available on VITS lines only
Noise Measurement Signals		
Pedestal Amplitude		
50 mV	50 mV ±5 mV	
350 mV	350 mV ±7 mV	
700 mV	700 mV ±14 mV	
Variable Pedestal Range	At least ±50 mV from nominal, (100 mV Total)	Insertion Mode Only

TABLE 1-2 (cont)

Characteristics	Performance Requirements	Supplemental Information
Noise Amplitude	−20 dB to −59 dB (0 dB = 700 mV)	1 dB increments
Noise Attenuator Accuracy	Within 1 dB	
Noise Spectrum Bandwidth	15 kHz to 5 MHz, flat within 6 dB	
Timing	See Fig. 1-2	

TABLE 1-3

Full- Field Output

Characteristics	Performance Requirements	Supplemental Information
Full-Field Test Signal Outputs		
Relative Amplitudes	Within 1% at both outputs	
Return Loss	At least 36 dB to 5 MHz	
Sync and Burst Timing	See Figs. 1-3 and 1-4	
Sync Amplitude	300 mV ±1%	
Burst Amplitude	300 mV peak-to-peak ±3%	
Amplitude on Successive Lines	Smaller is 97% to 100% of the larger	
Phasing	+135° ±1° from +U axis on odd lines of the first and second fields and on even lines of the third and fourth fields −135° ±1° from +U axis on even lines of the first and second fields and on odd lines of the third and fourth fields Phase difference between burst on successive lines is 90° ±1°	
Chrominance Frequency		
Free Run	3.57561149 MHz ±25 Hz	
Locked Mode	Locked to incoming burst or external Subcarrier	Nominally 3.57561149 MHz ±5 Hz

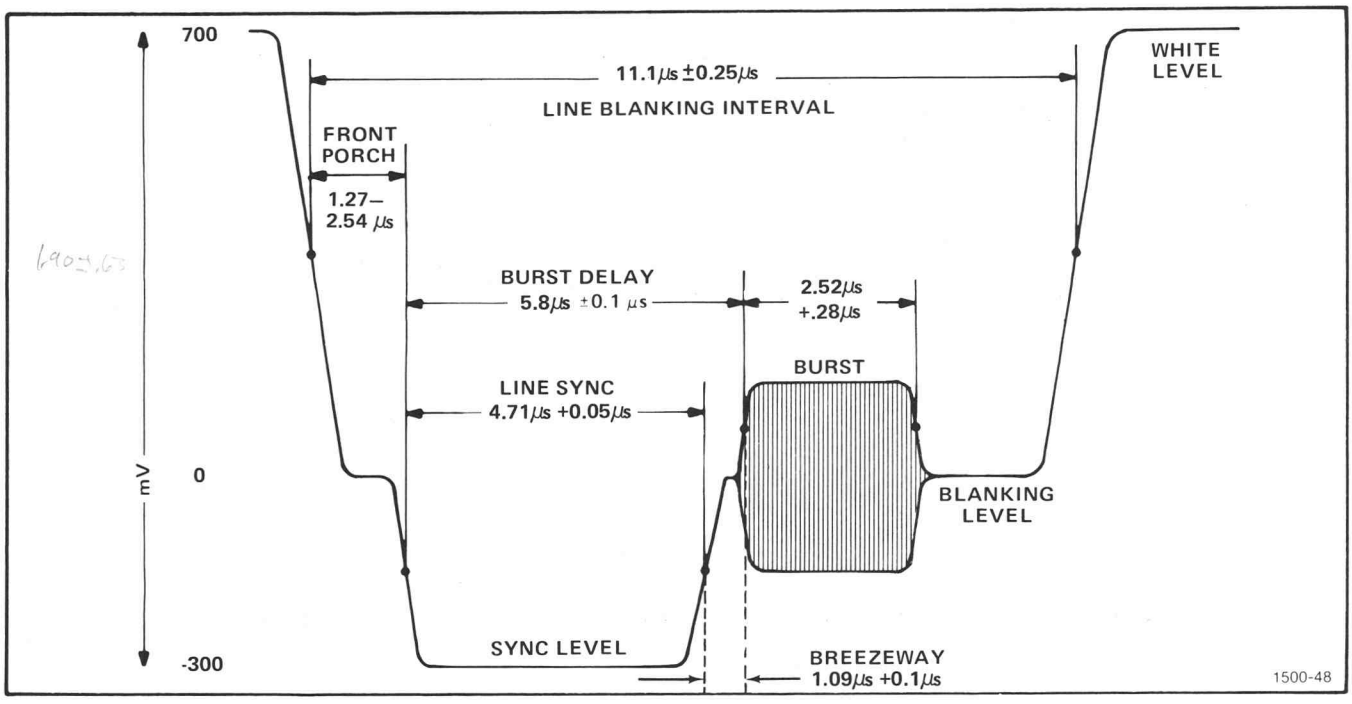


Fig. 1-3. Details of line synchronizing signals.

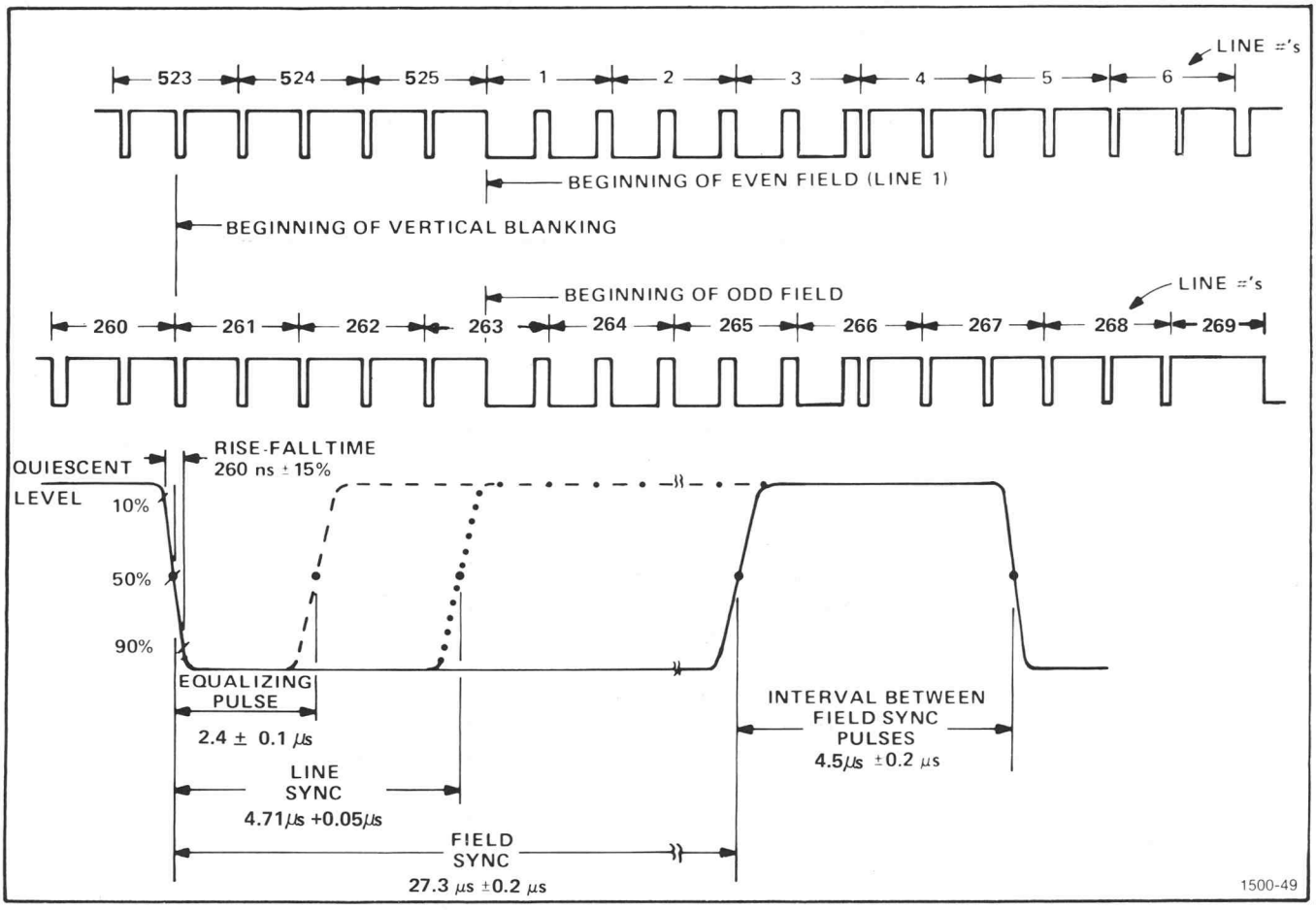


Fig. 1-4. Details of field (vertical) synchronizing signals.

TABLE 1-4

Other Signal Outputs and Inputs

Characteristics	Performance Requirements	Supplemental Information
Outputs		
COMPOSITE SYNC		Disabled with loss of incoming sync in INT or external sync in EXT
Amplitude	4 V, ±10%, negative-going into 75 Ω	
Return Loss	At least −30 dB to 3.6 MHz	
Rise and Fall Times	115 ns ±10%	
CW SUBCARRIER		Disabled with loss of incoming sync or burst in INT, or with loss of any input in EXT
Amplitude	2 V peak-to-peak, ±20%, into 75 Ω	
Return Loss	At least −30 dB to 5 MHz	
Frequency		Locked to incoming burst or EXT SUBCARRIER
NOISE		
Noise Amplitude	−20 dB to −59 dB (0 dB = 700 mV)	Low Pass (4.2 MHz)
Noise Attenuator Accuracy	Within 1 dB	
Noise Spectrum Bandwidth	15 kHz to 5 MHz, flat within 6 dB	
Return Loss	At least −30 dB to 5 MHz	
Inputs		
COMPOSITE SYNC		
Amplitude	2 V peak-to-peak nominal	
Return Loss	At least −30 dB to 5 MHz	Using external 75 Ω termination
BURST FLAG		
Amplitude	2 V peak-to-peak nominal	
Return Loss	At least −30 dB to 5 MHz	Using external 75 Ω termination
PAL PULSE		
Amplitude	2 V peak-to-peak nominal	
Return Loss	At least −30 dB to 5 MHz	Using external 75 Ω termination
SUBCARRIER		
Amplitude	2 V peak-to-peak nominal	
Return Loss	At least −30 dB to 5 MHz	Using external 75 Ω termination

TABLE 1-4 (cont)

Characteristics	Performance Requirements	Supplemental Information
EXT VITS IN		
Level	1 V peak-to-peak nominal	
Return Loss	At least −30 dB to 5 MHz	

TABLE 1-5

Gen Lock

Characteristics	Performance Requirements	Supplemental Information
Input Requirements		Input through PROGRAM LINE INPUT or EXT INPUTS
Sync Source	Nominal 1 V peak-to-peak composite video	
Sync Amplitude	300 mV, within 6 dB	
Burst Amplitude	300 mV, within 12 dB	
Burst/Sync Ratio	Within 6 dB	
Subcarrier Performance		
Phase Error		
With Frequency Change	Within 1° with input burst variation of ±10 Hz from 3.57561149 MHz, nominal burst level	
With Burst Amplitude Change	Within 1° with amplitude change of 3 dB. Within 3° with change in Burst/Sync ratio of −6 dB to +10 dB	
Phase Stability		
Breezeway Effect (See Fig. 1-3 for Location of Breezeway)	0.2° or less for burst timing errors including burst width variance (8-10 cycles) and breezeway variance (±0.28 μs)	
Dynamic APL	0.1° or less with APL variation from 10% to 90%	
Noise Effect	Within 1° with RMS White noise at 24 dB below 700 mV peak-to-peak picture signal	
INSERT SUBCARRIER PHASE		
Range	±10° nominal, via front-panel adjustment	

TABLE 1-5 (cont)

Characteristics	Performance Requirements	Supplemental Information
Subcarrier Lock		
Lock-up Amplitude	At least 150 mV peak-to-peak of burst information to lock	
Drop-out Amplitude	50 mV or less of burst information will allow unlock	(CW Mode)
Loss of Subcarrier Lock		Internal Subcarrier free runs at 3.57561149 MHz ±25 Hz. Subcarrier is not phase locked to sync if external sync is present
Loss of Sync		Indicated by front-panel lamp. Instrument returns instantly to internal subcarrier
INSERT DELAY Range	±0.5 μs (1 μs Total)	

TABLE 1-6

Power Supply

Characteristics	Performance Requirements	Supplemental Information
Line Voltage Range		
115 VAC		
Low	90 V to 110 V	
Medium	104 V to 126 V	
High	112 V to 136 V	
230 VAC		
Low	180 V to 220 V	
Medium	208 V to 252 V	
High	224 V to 272 V	
Crest Factor	At least 1.35	
Line Frequency	48 to 66 Hz	
DC Supply Accuracy		
−15 V		Within 1%
+15 V		Within 1%
+5 V		Within 1%

TABLE 1-6 (cont)

Characteristics	Performance Requirements	Supplemental Information
Regulation		
−15 V		Within 1%
+15 V		Within 1%
+5 V		Within 1%
Ripple		
−15 V		10 mV or less
+15 V		10 mV or less
+5 V		10 mV or less
Maximum Power Consumption	55 V	

TABLE 1-7

Physical

Characteristics	Information			
Finish	Cabinet is blue-vinyl painted; front-panel is anodized aluminum			
Dimensions				
Overall	Rackmount Version		Benchmount Version	
Height	8.81 cm	(3.470 inches)	9.70 cm	(3.820 inches)
Width	48.26 cm	(19.000 inches)	46.29 cm	(18.225 inches)
Length	49.94 cm	(19.66 inches)	48.51 cm	(19.100 inches)
Cabinet				
Height	- - - - -	- - - - -	8.81 cm	(3.470 inches)
Width	42.88 cm	(16.880 inches)	43.43 cm	(17.100 inches)
Length	46.76 cm	(18.410 inches)	46.76 cm	(18.410 inches)
Width Over Sides	44.77 cm	(17.625 inches)	- - - - -	- - - - -
Length with BNC-T	47.24 cm	(18.600 inches)	48.03 cm	(18.910 inches)
Net Weight	9.07 kg	(20 lbs.)	8.26 kg	(19 lbs.)

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ENVIRONMENTAL CHARACTERISTICS

The following environmental test limits given in Table 1-8 apply when tested in accordance with the recommended test procedure. This instrument will meet the electrical performance requirements given in this section following an environmental test. Complete details on environmental test procedures, including failure criteria, etc., may be obtained from Tektronix, Inc. Contact your local TEKTRONIX Field Office or representative.

TABLE 1-8
Environmental

Characteristic	Information
Temperature	
Non-Operating Range	−40° C to −65° C
Operating Range	0° C to +50° C
Altitude	
Non-Operating Range	To 50,000 feet
Operating Range	To 15,000 feet

ACCESSORIES

Standard accessories supplied with this instrument are listed in the Mechanical Parts List.

OPERATING INSTRUCTIONS

General

This section of the manual is intended to provide the operator with information necessary for proper operation of the 148-M. Included are (1) Initial Installation information dealing with the various line voltages that may be used to power the instrument, and information regarding Local or Remote operation; (2) Controls and Connectors, a brief discussion of each control and connector; (3) Basic Information, dealing with the different signals generated by the 148-M and how they might be used; (4) First Time Operation, a complete step-by-step procedure using each control and connector; (5) Operating Changes, dealing with all internal changes that can be made for different applications; and (6) Glossary of Terms.

We recommend that the user of this instrument refer to the following reference material as a supplementary source of information.

Weaver, L.E.: TELEVISION VIDEO TRANSMISSION MEASUREMENTS, Marconi Instruments Limited, St. Albans, Herefordshire, England (FEB, 1972)

Television Products Application Notes, Tektronix, Inc.

INSTALLATION

Operating Voltage

WARNING

The instrument is intended to be operated from a single-phase power source that has one of its current carrying conductors (The Neutral Conductor) at or near ground (earth) potential. Operation from other power sources where both current carrying conductors are live with respect to ground (such as phase-to-phase on multi-phase systems) is not recommended, as only the Line Conductor has overcurrent (fuse) protection within the instrument.

The 148-M may be operated from either 115-Vac or 230-Vac (nominal) line voltage source. Quick-change line-voltage plugs, located under the fuse cover on the rear panel, change the transformer primary connections so that the instrument will operate from one line voltage or the other (115 V or 230 V). In addition, the plugs permit one of three line voltage operating ranges to be selected. Table 2-1 lists the voltage ranges that enable the instrument dc power supplies to regulate properly.

TABLE 2-1

115/230 Voltage Selector Plug Position	Range Selector Plug Position	Nominal Line (Center) Voltage	Line Voltage Plug Range[1]	Fuse Values
115 V	LO (Low)	100 Vac	90 to 110 Vac	0.75 A Fast-Blow
	M (Medium)	115 Vac	104 to 126 Vac	
	HI (High)	124 Vac	112 to 136 Vac	
230 V	LO (Low)	200 Vac	180 to 220 Vac	0.5 A Fast-Blow
	M (Medium)	230 Vac	208 to 252 Vac	
	HI (High)	248 Vac	224 to 272 Vac	

[1]**Applicable when the line contains less than 2% total distortion.**

Operating Instructions—148-M

To convert to a different line voltage, proceed as follows:

1. Disconnect the 148-M from the power source.

2. Unscrew the two captive screws holding the fuse cover. Remove the cover and attached fuses.

3. Pull out the 115/230 Voltage Selector plug, see Fig. 2-1, then rotate the plug 180° and insert it into the opposite set of holes. The 115/230 Voltage Selector plug is located in the upper position for 115 V operation, and in the lower position for 230 V operation.

4. To change the line-voltage operating range (LO, M, or HI), pull out the Range Selector plug and insert it in the desired hole locations. Select a range with a center voltage (see column three in Table 2-1) closely corresponding to the line voltage that will be applied in regular instrument operation.

5. Re-install the cover with the two captive screws and fuses. Be sure the cover fits firmly against the rear panel. This ensures that the line fuses are seated properly in the fuse clips.

6. Before applying power to the instrument, check that the indicating tabs on the selector plugs protrude through the proper holes in the cover for the correct line voltage and the proper operating range.

CAUTION

The 148-M should not be operated with the 115/230 Voltage Selector and/or Range Selector plugs in the wrong position for the line voltage applied.

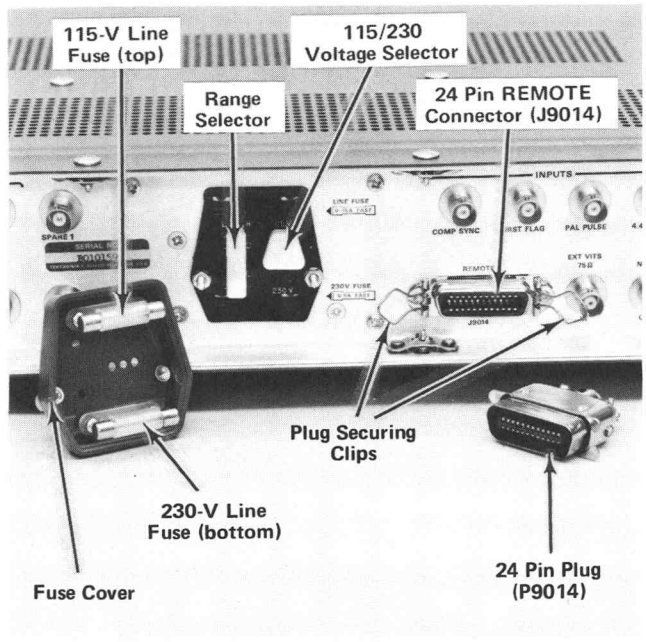


Fig. 2-1. Location of Range and Voltage Selector plugs with fuse cover removed (plugs as shown are set for 115-V medium range operation). Also shown is the REMOTE (J9014) connector, Plug (J9014), and plug securing clips.

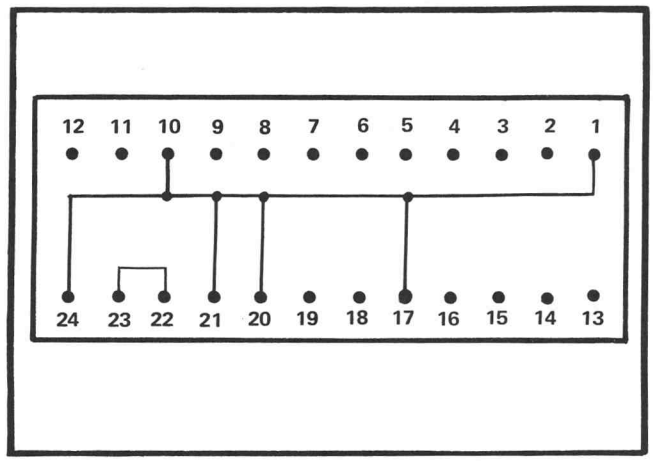


Fig. 2-2. Wiring diagram of Remote Plug for LOCAL operation (factory connected).

Local-Remote Connector

The 148-M may be operated by local or remote means. (Local means 148-M operation from the front panel.) A multi-pin connector, REMOTE J9014 is incorporated on the rear panel, see Fig. 2-1. Installed to this is a REMOTE plug, P9014, Tektronix Part No. 131-0325-00. This plug is factory wired for LOCAL operation, see Fig. 2-2.

To operate Remote, separate switching must be used at the remote location(s). In addition, the multi-pin plug must be wired accordingly. Fig. 2-3 shows the external switching required for remote control of FULL FIELD, PROGRAM, and PROGRAM LINE OUT FULL FIELD BYPASS. The external switching may be separate or combined to be controlled by one operator. Once the necessary wiring is complete, reconnect the plug to the REMOTE connector (J9014) and lock into place with the two securing clips.

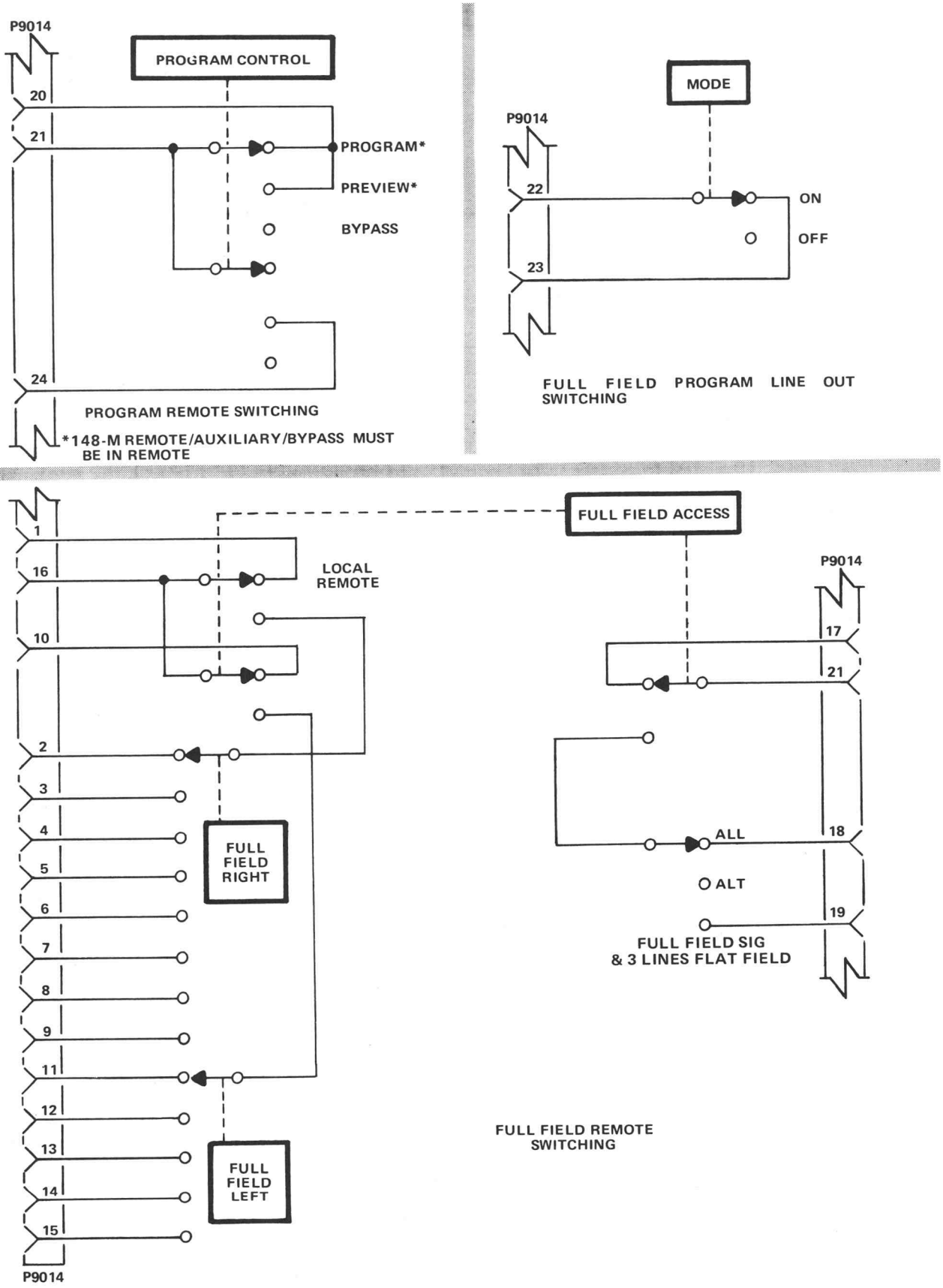


Fig. 2-3. Wiring diagrams for REMOTE operation of the 148-M.

CONTROLS AND CONNECTORS

Introduction

The following describes the functions and operation of the 148-M controls and connectors. Refer to Fig. 2-4 for locations of the controls and connectors.

Front-Panel Controls

POWER — Toggle switch—turns instrument ON and OFF. Green lamp indicates when POWER switch is ON and the instrument is connected to a line voltage source.

SYNC — Selects source of synchronization references.

INT position — Selects timing derived from the program signal.

EXT position — Selects timing derived from signals connected to COMP SYNC, SUB-CARRIER, PAL PULSE and BURST FLAG input connectors.

NOT LOCKED TO PROGRAM Light — Red light—indicates a loss of incoming synchronization information (e.g., loss of incoming program signal or external inputs). In this state, no VITS will be inserted. Full-field signals are generated, but line and field sync are not locked to subcarrier.

INSERTION SIGNAL CONTROL — Selects signal modes and controls their amplitude, phase, and timing relationships.

UNITY GAIN/VAR — UNITY GAIN Position selects a preset gain, normally adjusted for unity gain between program input and program output.

VAR position connects the front-panel LEVEL control to vary the gain of the program amplifier, allowing the incoming signal to match the inserted signal amplitude.

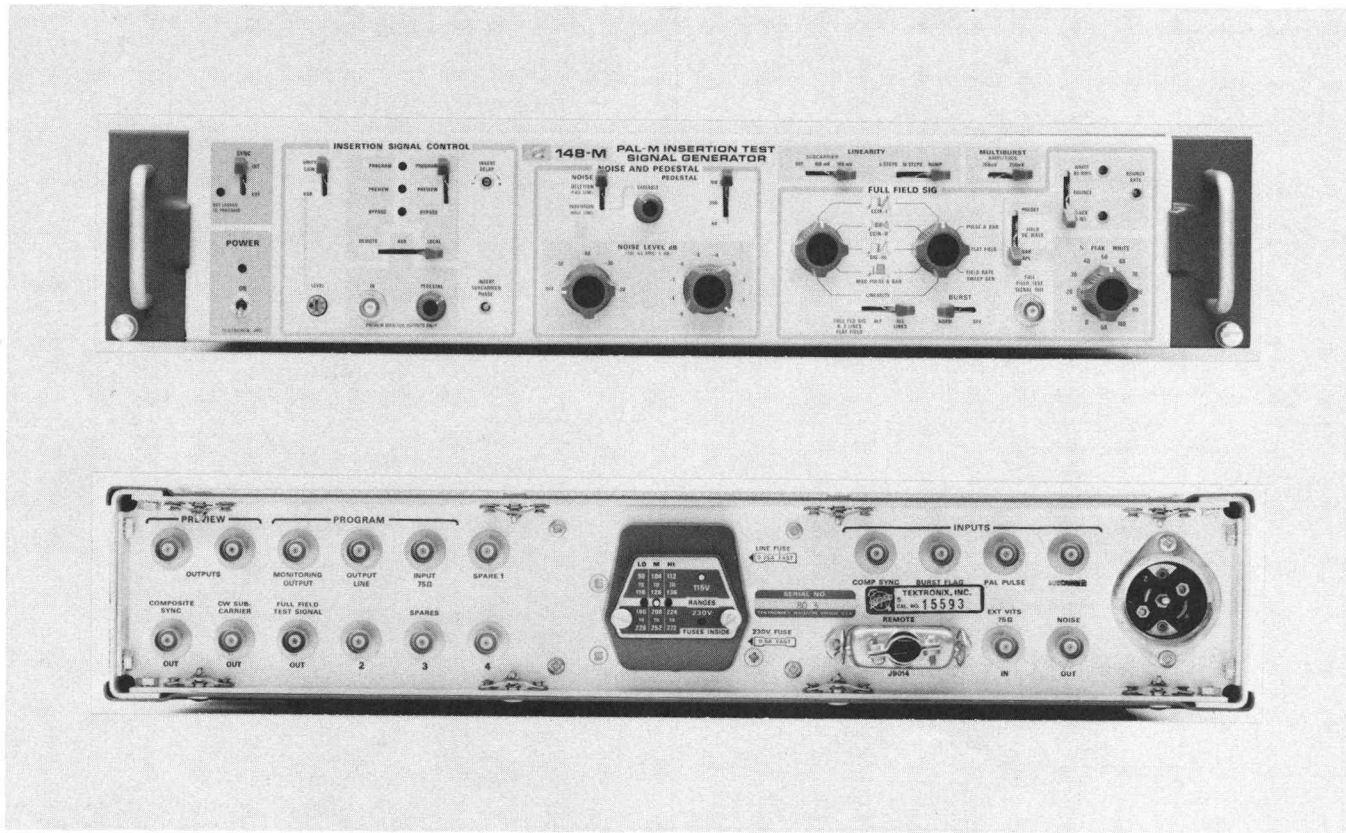


Fig. 2-4. 148-M front- and rear-panel controls and connectors.

LOCAL/AUX/REMOTE

LOCAL Position enables front-panel control of 148-M program or preview modes.

AUX permits a non-video signal (e.g., noise or sinewave) at the AUXILIARY INPUT to be used. This signal then appears at the PREVIEW outputs as composite video. The 148-M is then operating as a sync and blanking inserter. (PROGRAM IN is connected via relay to PROGRAM OUT in this mode.)

AUXILIARY PEDESTAL control provides a dc offset so the auxiliary signal excursion can be positioned between black and white limits of the resulting composite video signal.

In the REMOTE position, operation is controllable by remote switching circuits attached to the rear-panel REMOTE connector.

PROGRAM/PREVIEW BYPASS

PROGRAM position inserts VITS on the PROGRAM, PROGRAM MONITOR, and PREVIEW outputs according to internal programming of test signals.

PREVIEW inserts VITS on the PREVIEW outputs only, allowing verification prior to inserting VITS on PROGRAM OUT.

In BYPASS, incoming signals are switched by relay to the PROGRAM OUTPUT; bypassing the active circuits of the 148-M.

PROGRAM/PREVIEW BYPASS Lamps

When in remote control, the status may not be indicated by the position of the PROGRAM/PREVIEW/BYPASS switch. Green, yellow, and red lamps indicate the status of PROGRAM, PREVIEW, and BYPASS in that order. All lamps extinguished indicates an improper condition, and the 148-M will be in the bypass state.

INSERT SUB-CARRIER PHASE

Screwdriver adjustment controls the phase of the color subcarrier on internally generated signals with respect to the incoming color burst signal.

INSERT DELAY

Adjusts time-positioning of internally generated insertion signals with respect to the incoming signal.

NOISE AND PEDESTAL

Selects conditions of the NOISE signal.

NOISE

Controls information on the VITS lines programmed for NOISE.

DELETION (FULL LINE) deletes incoming VITS on NOISE LINES and inserts a selected PEDESTAL without noise.

INSERTION (HALF LINE) deletes center half of incoming VITS on NOISE lines and inserts half line of VARIABLE PEDESTAL with NOISE. (FULL FIELD OUT has a full line of NOISE and PEDESTAL on VITS lines.)

PEDESTAL (mV)

Switch selects one of three indicated levels (50, 350, or 700 mV) of pedestal on which noise measurements can be made.

VARIABLE

Potentiometer controls a change of at least ±50 mV in the pedestal amplitude, with the NOISE switch in the INSERTION mode. Permits accurate matching of the pedestal level with the level of the measured signal.

NOISE LEVEL dB

Controls the amplitude of the internally generated noise signal from −20 dB to −59 dB in 1 dB and 10 dB increments.

FULL FIELD SIG

Switches and adjustments select the type of signal available at the FULL FIELD TEST SIGNAL OUT jack, and modify certain characteristics of these signals.

Signal Selector (Right)

Selects one of the following eight signals for FULL FIELD TEST SIGNAL OUT: CCIR-I, CCIR-II, SIG-III, MOD PULSE & BAR, LINEARITY, FIELD RATE SWEEP GEN, FLAT FIELD, and PULSE & BAR.

Signal Selector (Left)

Selects one of the following five signals to be alternated with the signal selected by the (Right) Signal Selector: CCIR-I, CCIR-II, SIG-III, MOD PULSE & BAR, and LINEARITY. Switch is inoperative unless the ALL LINES/ALT/FULL FIELD SIG & 3 LINES FLAT FIELD switch is in the alternating (ALT) position.

ALL LINES/ALT/ FULL FIELD SIG & 3 LINES FLAT FIELD

Switch selects the sequence of full-field signals.

ALL LINES position puts the signal selected by the right switch on all active lines.

ALT interleaves signals selected by the Right and Left switches on alternate lines.

FULL FIELD SIG & 3 LINES FLAT FIELD sequence is one line of signal selected by the Right switch followed by 3 lines of adjustment pedestal.

FLAT FIELD

Level switch selects amplitude and time of the FLAT FIELD signal.

PRESET

FLAT FIELD signal is controlled by the WHITE/BOUNCE/BLACK switch.

WHITE provides a full-field level between 85% and 100% of peak white. Adjustable by adjacent control.

BLACK is a level between 0% and 15% of peak white, adjustable by adjacent control.

BOUNCE switches between the preset limits of BLACK and WHITE at a rate from 1 to 10 seconds, adjustable by the BOUNCE RATE control.

FIELD SQ WAVE

A 50% duty cycle, 60 Hz squarewave with beginning and end of field at 0% level, and the center of the field at 100% peak white. (Useful in field time distortion measurements.)

VAR APL

% PEAK WHITE switch selects one of eleven levels of FLAT FIELD signal in 10% steps. (50% level is repeated for a rapid change from 0% to 50% to 100%.)

LINEARITY

Switches select components of the LINEARITY test signal.

SUBCARRIER

OFF disables all subcarrier on the LINEARITY signal.

100 mV position selects that amount of peak-to-peak subcarrier, phased at 180° from the +U axis, on the chosen LINEARITY Luminance signal.

140 mV position modulates the luminance signal with 140 mV peak-to-peak of 180° subcarrier.

5 STEPS/10 STEPS/RAMP

5 STEPS position choses a LINEARITY staircase with 5 equal steps.

10 STEPS selects a 10 step staircase.

RAMP selects a linear ramp from black to white.

MULTIBURST AMPLITUDE

700 mV position refers to peak-to peak amplitude of multiburst portion of the CCIR-II signal, centered about 350 mV pedestal.

350 mV position refers to peak-to-peak amplitude of multiburst portion of the CCIR-II signal, centered about a 350 mV pedestal.

BURST

NORM selection allows color burst to be inserted in the normal manner on the full-field signal.

OFF deletes color burst from the full-field signal.

Input Connectors

All input signals (except Remote Plug) are via BNC-type connectors.

AUX IN (1, front-panel)	75 Ω input for non-composite video type signals.
EXT VITS IN (1, rear-panel)	75 Ω input, added to composite video; output to deleter and inserter circuit. Must not have insertion signals on the lines programmed for other 148-M insertion signals. (Must not have sync and burst if not disconnected when AUXILIARY is used.)
PROGRAM LINE IN (1, rear-panel)	75 Ω input for program signal.
Remote Plug (1, rear-panel)	24-pin connector for wiring remote control functions.
COMP SYNC (1, rear-panel)	High impedance input for external synchronization of full-field signals.
PAL PULSE (1, rear-panel)	High impedance input for external synchronization of full-field signals.
BURST FLAG (1, rear-panel)	High impedance input for external synchronization of full-field signals.
SUBCARRIER (1, rear-panel)	High impedance input for external synchronization of full-field signals.

Output Connectors

All output connectors are BNC-type with 75 Ω impedance.

PROGRAM LINE (1, rear-panel)	Program output signal, with insertion signals added or deleted according to program control.
PROGRAM MONITOR (1, rear-panel)	Same as PROGRAM LINE OUT, except no output present in BYPASS mode.
PREVIEW MONITOR (2, rear-panel)	Always have insertion signals added and may have AUXILIARY added.
FULL FIELD TEST SIGNAL (1, front and 1, rear-panel	Full-field test signal.
CW SUBCARRIER (1, rear-panel)	Regenerated subcarrier signal, approximately 2 volts peak-to-peak. Not present unless locked to incoming signals.
COMPOSITE (1, rear-panel)	Regenerated sync signal, approximately 4 volts negative. Not present unless locked to incoming sync.
NOISE OUT (1, rear-panel)	Continouous random noise, variable from −20 dB to −59 dB (0 dB =700 mV).

GENERAL INFORMATION

Television signals are complex waveforms. For this reason, many test units are required to check one characteristic or another of the video system.

The 148-M is one such test unit, but it differs from others in that it will provide all the signals necessary for complete time-domain testing of a video system. All signals generated are controlled by a digital programmer that is Gen-Locked (normally), but may operate from its own oscillator. The 148-M generates the signals shown in Fig. 1-2 of this manual.

LINEARITY—Staircase, either 5 or 10 step, or ramp is available. Subcarrier (phase locked to burst) modulates either the staircase or ramp, and may be turned off by a front-panel control. Measurement of Differential Gain and Differential Phase may be made using the LINEARITY signal.

CCIR-I—This signal is a composite of the Bar, Pulse, Modulated Pulse, and Modulated 5 Step Staircase signals. These signals provide for making several types of measurements on one VITS line.

CCIR-II—This signal contains two useful test signals during one line period. It consists of a Multiburst and a Modulated Pedestal.

The Multiburst signal consists of a white flag (700 mV), and six discrete packets of frequencies from 0.5 MHz to 4.2 MHz. Each burst packet may be set for an exact number of cycles, regardless of the frequency. Multiburst is generally used for quick frequency response verification.

The Modulated Pedestal signal consists of three chrominance levels modulated on the 350 mV pedestal. This signal is useful for determining chrominance-to-luminance crosstalk.

SIG-III—Similar to the CCIR-I signal, except it has no modulation on the 5 Step Staircase.

MOD PULSE & BAR—Consists of a 12.5T Modulated Sin^2 Pulse, and a Modulated Sin^2 Bar with 12.5T rise- and fall-times. This signal is used to measure linear distortions such as chrominance-to-luminance delay and gain inequalities.

PULSE & BAR—Similar to the CCIR recommended signal, except the Bar portion of the signal is only present during the center 152 lines of each field. This signal is used for measuring linear distortions during both line and field time.

FIELD RATE SWEEP GEN—This signal consists of a sinewave that is swept in frequency from about 200 kHz to more than 6 MHz during each field period. Markers are spaced at about 1 MHz intervals. Composite sync and blanking are added to make the signal compatible with clamper circuits. The primary use of the signal is for gain vs. frequency checks.

FIELD SQ WAVE—This signal, similar to the PULSE & BAR signal, has line 74 through 206 of each field at 700 mV, thereby simulating a 60 Hz square-wave. It is capable of passing through clamper amplifiers and is used for accurate measuring of field time distortions.

FLAT FIELD—This composite video signal has, during the active portion of each field, a luminance level variable from 0 to 700 mV in 10% increments, or which bounces automatically between the black and white level at a repetition rate of approximately 1 to 10 seconds. It is used to test clamped amplifiers and systems in general, and for APL-dependent distortions.

NOISE—The calibrated noise generated provides white noise (flat) at 50, 250, or 700 mV luminance levels. This offers a unique signal-to-noise measuring technique, which may be performed during the vertical interval.

FIRST TIME OPERATION

General

The following is primarily intended to familarize operating personnel with the operation of the 148-M. It consists of a step-by-step procedure, which makes use of each front- and rear-panel control and connector. This procedure in most cases simulates the actual in-service operation of the 148-M.

The procedure makes use of a waveform monitor to observe field and line rate displays and a vectorscope to observe phase characteristics. An external video signal source is needed to provide program signal (composite video) and an external Vertical Interval Test Signal (VITS). The following equipment is used: Tektronix 1482 Waveform Monitor, used to observe field and line rate displays; a Tektronix 522A Vectorscope, used to observe phase characteristics; and a Tektronix 145-M Test Signal Generator, used to provide the external video signals. Proper operation of each unit is assumed; refer to the individual operating instructions for each.

Unless stated otherwise, all 148-M front- and rear-panel controls and connectors are in upper-case letters and all other controls and connectors have initial upper-case letters only.

The procedure is arranged in a sequence that depends upon previous control settings and connections, and should be performed in sequence. There are, however, certain places where all equipment is disconnected before starting a step, allowing the operator to start the procedure at this point if desired.

NOTE

The following procedure uses the equipment listed. If substitute equipment is used, control settings and connections may need to be altered .

Procedure

1. Remove the REMOTE plug, P9014.

2. Set the 148-M controls as follows:

Control	Position
INSERTION SIGNAL CONTROL	UNITY GAIN, PROGRAM, and LOCAL
SYNC	INT
POWER	off
NOISE AND PEDESTAL	DELETION, 700 mV, OFF, and 0 dB
FULL FIELD SIG	LINEARITY (Left and Right Selectors) ALL LINES
LINEARITY	5 STEP, 140 mV SUB-CARRIER
MULTIBURST AMPLITUDE	700 mV
FLAT FIELD	PRESET, BLACK 0-15%, and 100% PEAK WHITE
BURST	NORM

3. Check 148-M Range and Voltage selectors for correct positioning.

4. Set the POWER switch ON. Note that the green power-on light, the red NOT LOCKED TO PROGRAM light, and the red BYPASS light are all on.

NOTE

Without Gen-Lock, the 148-M will not delete or insert VITS.

5. Connect the 148-M front-panel FULL FIELD TEST SIGNAL OUT to the Waveform Monitor A Input; terminate the loop-through A Input into 75 Ω.

6. Using the 2 Field Display rate of the Waveform Monitor, note that composite sync and burst are the only signals being generated. Set the Waveform Monitor to the 10 μs/Div position.

7. Connect the REMOTE plug, P9014. Note that the 5 Step LINEARITY signal is now displayed, and the green PROGRAM light is on.

8. Change the LINEARITY switches to display the 10 Step and Ramp LINEARITY signals modulated by the amount of chrominance selected by the SUBCARRIER switch. Return the switches to display the 5 Step signal with 140 mV modulation.

9. Set the FULL FIELD SIG (Right) selector switch to FLAT FIELD. The Waveform Monitor will display a level between 0% and 15% of peak white. Using a small-bladed screwdriver, adjust the BLACK 0-15% control. The level will change from 0% to 15% of peak white.

10. Set the WHITE/BOUNCE/BLACK switch to WHITE. The level should now be between 85% and 100% of peak white. Adjust the WHITE 85-100% control to check its range.

11. Set the WHITE/BOUNCE/BLACK switch to BOUNCE. The signal level will alternate between the limits of BLACK and WHITE, as set by the 0-15% and 85-100% controls. Turn the BOUNCE rate control through its range. The rate of alternation between BLACK and WHITE will vary according to the setting of this control.

12. Set the FLAT FIELD mode switch to FIELD SQ WAVE, and the Waveform Monitor to a 2 Field Display rate. Note that the signal resembles a 60 Hz square-wave. Return the Waveform Monitor to 10 μs/Div.

13. Set the FLAT FIELD mode switch to VAR APL. Look for a 100% peak white (700 mV) level on the signal. Change the VAR APL switch through its settings and note the correct amplitude on the Waveform Monitor. The 50% level is repeated between the 0% and 100% positions to allow quick APL shifts.

14. Set the FULL FIELD SIG (Right) selector switch to FIELD RATE SWEEP GEN. This signal is a swept frequency sinewave, modulated on a 350 mV pedestal. Change the Waveform Monitor to a 2 Field Display rate. See that the modulation is blanked seven times per field. These blanked spots (markers) are spaced at about 1 MHz intervals. Return the Waveform Monitor to the 10 μs/Div Display rate. Set the MULTIBURST AMPLITUDE switch to 350 mV. The amplitude of the FIELD SWEEP GEN modulation goes from 700 mV to 350 mV.

15. Set the FULL FIELD SIG (Right) selector switch to CCIR-II. This signal will be the same as shown in Fig. 1-2. Set the MULTIBURST AMPLITUDE switch to 700 mV. Notice that only the MULTIBURST packets change amplitude, going from 350 mV to 700 mV.

16. Check the remaining positions of the FULL FIELD (Right) selector switch; CCIR-I, SIG-III, MOD PULSE & BAR, and PULSE & BAR. See that these signals match those shown in Fig. 1-2.

17. Set the FULL FIELD SIG mode switch to ALT. Set the right hand selector to FLAT FIELD, and the left hand selector to LINEARITY. The FLAT FIELD and LINEARITY signals will look superimposed. Change the left and right hand selectors to see that all of the signals selected by the left hand selector can be superimposed with all of the signals selected by the right hand selector. Set the Waveform Monitor to a 2 Field Display rate, with the horizontal Mag at X50. Position the display to show the active portion of a field. The signals will appear on alternate lines throughout the field.

18. Set the FULL FIELD SIG mode switch to FULL FIELD SIG & 3 LINES FLAT FIELD. The signal chosen by the right hand selector will be on every fourth line with the remaining three lines having the FLAT FIELD SIGNAL. The usual way to use this feature is to select a LINEARITY signal and vary the VAR APL % PEAK WHITE switch from 0% to 50%, then to 100%. This makes quick measurements for APL dependent distortions. Return the FULL FIELD SIG mode switch to ALL LINES.

19. Set the Waveform Monitor Mag to Off, and to 10 μs/Div Display rate. Turn the BURST switch off. Burst is removed from the composite video signal on the Waveform Monitor. Return the BURST switch to the NORM position.

NOTE

In steps 8 through 19, each FULL FIELD TEST SIGNAL has been demonstrated. Also, these signals were demonstrated in a free-running mode. In the free-running mode, the subcarrier free-runs at approximately 3.58 MHz.

In the steps to follow, the procedure will, where possible, simulate the actual in-service operation of the 148-M.

20. Using 75 Ω coaxial cables and 75 Ω terminations make the following connections:

a. 148-M PROGRAM OUTPUT LINE to Waveform Monitor A Input, A Input loop-through to the Vectorscope CH A input; terminate CH A loop-through into 75 Ω.

c. External Video Source subcarrier to the Vectorscope Ext CW ϕ Ref Input, terminate Ext CW ϕ Ref loop-through into 75 Ω.

d. External Video Source composite sync to the Waveform Monitor Ext Neg Sync Input, Ext Neg Sync Input loop-through to Vectorscope Ext Sync Input, terminate Ext Sync Input loop-through into 75 Ω.

e. External Video Source composite video to the 148-M PROGRAM INPUT.

21. Set the 148-M controls and switches as given in step 2 of this procedure, except set the POWER switch ON and the INSERTION SIGNAL CONTROL to PREVIEW. Set the Vectorscope to view the CH A Input (PROGRAM OUTPUT LINE) in a vector mode using external sync and ϕ reference. Set the Waveform Monitor to view the A Input (PROGRAM OUTPUT LINE) at a 2 Line Display rate using external sync. Set the External Video Source for full-field color bars with a Vertical Interval Test Signal (this procedure makes use of a modulated staircase VITS) on lines 13/276, both fields.

22. Notice that the 148-M front-panel NOT LOCKED TO PROGRAM lamp is extinguished. This indicates the 148-M has been Gen-Locked with the external video and is capable of deletion and insertion. (If this lamp is lit, check that the SYNC switch is set to INT.)

23. Notice that the 148-M PREVIEW lamp is lit to indicate status. In this mode, the external video to the PROGRAM INPUT is being passed to the PROGRAM OUTPUT without interruption, as indicated by the Waveform Monitor and Vectorscope displays.

24. Observe the Waveform Monitor B Input (PREVIEW OUTPUT) at a 2 Field Display rate (use maximum magnification if desired). Notice that the internally generated VITS have been added to the signal. The signal appearing at the PREVIEW OUTPUT in the PREVIEW mode allows the operator to observe the actual signal after insertion without actually going to an "on-the-air" mode of operation.

25. Using Table 2-2, check that all VITS are being inserted on the correct line and field.

26. Set the 148-M INSERTION SIGNAL CONTROL to PROGRAM. Observe the Waveform Monitor A Input (PROGRAM OUTPUT LINE). Notice that the internally generated VITS have been applied to the "on-the-air" signal. Note also that the 148-M front-panel PROGRAM lamp is lit to indicate status.

TABLE 2-2

148-M Factory Commands
VITS Programming

Line	Fields	Signal
14/277	All	NOISE
15/278	All	LINEARITY
16	1,3	SIG-III
17	1,3	CCIR-I
279	2,4	MOD PULSE & BAR
280	2,4	CCIR-II

27. Set the External Video Source to provide a VIT Signal on one of the lines that has been programmed for insertion by the 148-M. Observing the Waveform Monitor display, set the 148-M POWER switch OFF. Note that the external VIT Signal is being displayed. This indicates that external video has bypassed the 148-M, and demonstrates the fail-safe characteristic of the 148-M should loss of power, sync etc., occur during "on-the-air" (PROGRAM) situation. Return the POWER switch to ON.

28. Observing the Waveform Monitor display, interrupt the external composite video to the 148-M PROGRAM INPUT. Notice that the display now consists of the Full-Field signal (as set by the FULL FIELD SIG switch) generated by the 148-M. In the event of loss of incoming video, the 148-M provides internally generated Full-Field test signals at the PROGRAM OUTPUT. (For exception, see Operating Changes, this section for details.) Return the external composite video signal to the 148-M PROGRAM INPUT.

29. Set the Waveform Monitor to view line 14, fields 1 and 3. Set the External Video Source to provide a VIT Signal on line 14, fields 1 and 3. This signal is controlled by the NOISE AND PEDESTAL controls. Set the PEDESTAL (mV) switch to 350 mV, then 50 mV, and back to 700 mV. Note that the pedestal amplitude corresponds to the setting of this switch. (In the DELETION mode, this is the only switch affecting the signal.) Set the NOISE switch to INSERTION. The display should be similar to that obtained in the DELETION mode. Rotate the VARIABLE control. Note that the pedestal level can be changed above and below the level determined by the setting of the PEDESTAL switch. Set the NOISE LEVEL dB switches for −20 dB. Notice that noise has been added to the pedestal. Turn the dB switches through their ranges. They provide noise attenuation from −20 dB to −59 dB in 1 dB steps. (700 mV RMS = 0 dB). Set the dB switches for −20 dB. Rotate the VARIABLE control to center the noise about the 700 mV level.

NOTE

Actual in-service noise measurements will require the use of a 4.2 MHz low-pass filter between the output of the 148-M and the input of the waveform monitor. If triangular noise must be measured, a 4.2 MHz weighting filter should be used. (See Fig. 2-5.)

30. Set the External Video Source to provide a VIT Signal on one of the lines programmed for internal VITS. Observe the Waveform Monitor B Input (PREVIEW OUTPUT) at a 2 Field Display rate. Notice that the external VITS has been deleted. Next, connect an external VIT Signal to the 148-M rear-panel EXT VITS INPUT. Do not terminate the line. (If using a Tektronix Type 145-M Test Signal Generator as the External Video Source, connect the unused Comp Video connector to the 148-M EXT VITS IN connector.) Notice that the external VITS (via the EXT VITS INPUT) has been added to the internally programmed VITS, causing the display to be distorted. This demonstrates why **external VITS to the EXT VITS INPUT must not be programmed on the same line and field as internal VITS.**

31. Observing the Waveform Monitor A Input at a 2 Field Display rate and the Vectorscope CH A Input vectors (both are PROGRAM OUTPUT), set the 148-M INSERTION SIGNAL control to PROGRAM, VAR, and rotate the LEVEL control. The amplitude of the external composite video can now be varied with this control. Observe the vertical interval on the Waveform Monitor with maximum magnification. Rotation of the LEVEL control should not affect the inserted test signals. Turn off the Waveform Monitor magnification and adjust the LEVEL control for an overall signal amplitude of 1 volt peak-to-peak. The LEVEL control allows the operator to match incoming program composite video to the internally generated signals. Set the INSERTION SIGNAL CONTROL to UNITY GAIN.

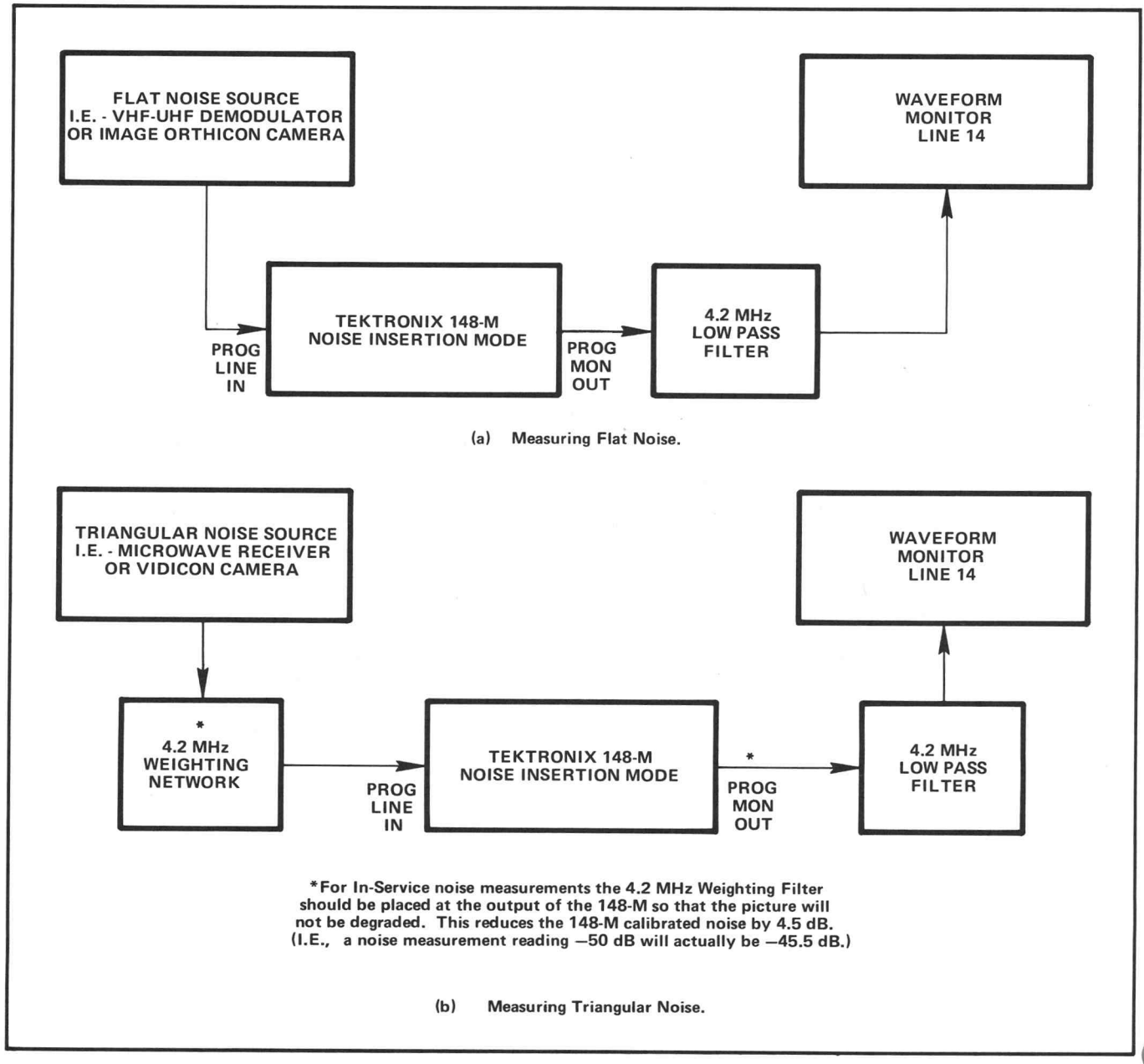
32. Observing the Vectorscope display, rotate the INSERT SUBCARRIER PHASE control. There will be a vector representing the internally generated subcarrier. Set the internal subcarrier to exactly 180° from the +U axis. The INSERT SUBCARRIER PHASE control enables the operator to match the phases of the internal and external subcarriers.

33. Set the 148-M INSERTION SIGNAL CONTROL to AUX and view the Waveform Monitor B Input (PREVIEW OUTPUT) at a 10 μs/Div Display rate. Sync and burst should be double amplitude. Disconnect the 75 Ω cable from the 148-M rear-panel EXT VITS INPUT. Sync and burst should be normal amplitude. This demonstrates why **in AUXILIARY mode and with an external VITS input, there must be no SYNC or BURST added with the external VITS.**

34. Observing the Wavefrom Monitor display, rotate the INSERTION SIGNAL CONTROL PEDESTAL control. Notice that an apparent square-wave can be adjusted from below blanking to greater than 700 mV. Display the PROGRAM MONITOR OUTPUT in place of the PREVIEW OUTPUT on the Waveform Monitor B Input. Notice that there is no output from this connector. Display the Waveform Monitor A Input (PROGRAM OUTPUT). Notice that external composite video is being displayed. The auxiliary signal will only be available at the PREVIEW OUTPUT. In addition, this is the only mode of operation where the PROGRAM OUTPUT and PROGRAM MONITOR OUTPUT do not have the same signals.

35. Display the PREVIEW OUTPUT in place of the PROGRAM MONITOR OUTPUT on the Waveform Monitor B Input. Apply the NOISE OUT signal from the 148-M rear-panel to the front-panel AUXILIARY INPUT connector. Notice that the NOISE signal applied to the AUXILIARY INPUT has been added to the auxiliary pedestal level. Position the auxiliary level to locate all of the NOISE signal between the blanking level and peak white.

36. Set the 148-M INSERTION SIGNAL CONTROL LOCAL/AUX/REMOTE switch to REMOTE. Note that the



(a) Measuring Flat Noise.

*For In-Service noise measurements the 4.2 MHz Weighting Filter should be placed at the output of the 148-M so that the picture will not be degraded. This reduces the 148-M calibrated noise by 4.5 dB. (I.E., a noise measurement reading −50 dB will actually be −45.5 dB.)

(b) Measuring Triangular Noise.

Fig. 2-5. Noise measurement setups.

PREVIEW lamp is lit to indicate status (unless PROGRAM/PREVIEW/BYPASS switch is in BYPASS, then BYPASS lamp is lit at all times). Observe the Waveform Monitor A Input first at a 2 Line Display rate, then a 2 Field Display rate. The external composite video should be appearing at this output without interruption.

37. Display the 148-M rear-panel NOISE OUT on the Waveform Monitor A Input; terminate the A Input loop-through into 75 Ω. Change the NOISE AND PEDESTAL switches. Note that the noise amplitude is controlled only by the NOISE LEVEL dB switches. The signal at this output is continuous (e.g., no line or field sync).

NOTE

An in-line low pass filter must be used with the NOISE OUT connector.

38. Display the 148-M rear-panel COMP SYNC OUTPUT on the Waveform Monitor. Set the Waveform Monitor for a 10 μs/Div Display rate. There will be a very large amplitude (4 V) sync pulse displayed. The bottom of the pulse will be off-screen. Set the 148-M SYNC switch to EXT. The sync pulse will disappear. The 148-M must be Gen-locked to produce an output at this connector. Return the SYNC switch to INT.

39. Connect the 148-M rear-panel CW SUBCARRIER OUTPUT to the Waveform Monitor. Terminate the loop-through into 75 Ω. The subcarrier will fill the screen of the Waveform Monitor. Set the SYNC switch to EXT. The subcarrier will disappear. The 148-M must be Gen-Locked to produce an output at this connector also.

40. Observing the Waveform Monitor display at either a 2 Line or 2 Field Display rate, set the 148-M SYNC switch to EXT. The display should be free-running and the red NOT LOCKED TO PROGRAM lamp should be lit. From the External Signal Source, connect, COMP SYNC, SUBCARRIER, BURST FLAG, and PAL PULSE to the respective input connectors on the 148-M rear-panel. Note that the red NOT LOCKED TO PROGRAM lamp is extinguished and that the display is locked.

This completes the first-time operating procedure.

OPERATING CHANGES

General Information

The 148-M is factory connected to generate test signals that are most frequently used by the television industry. However, many internal changes can be made to alter these signals to meet certain applications.

The following provides information necessary to change or modify the 148-M.

NOTE

Some of the changes or modifications that follow require internal adjustment and programming to comply with industry standards. We recommend that only qualified personnel, thoroughly familiar with calibration procedures and the video signals, make these changes.

Full Field Burst

As shipped from the factory, loss of burst on the PROGRAM IN signal (or loss of PAL pulse, burst flag, or subcarrier in the EXT SYNC mode) will cause the 148-M burst and subcarrier components of the FULL FIELD TEST SIGNALS to free run.

If desired, the free-running burst may be automatically removed from the FULL FIELD TEST SIGNALS with loss of incoming burst. Change the connector on pins 1 and 2 of P482 to pins 2 and 3 (P482 located on the Subcarrier and Sync Out circuit board, see Fig. 2-6).

Loss of Program (PROGRAM mode only)

As shipped from the factory, the FULL FIELD TEST SIGNALS are routed to the PROGRAM OUTPUT LINE in the event that the PROGRAM INPUT signal is interrupted. If desired, the 148-M may be connected so that the PROGRAM OUTPUT LINE is interrupted if the PROGRAM INPUT signal is interrupted. This is accomplished by disconnecting pins 22 and 23 of the remote plug, P9014. (P9014 is located on the rear-panel, see Fig. 2-1.)

ALT & 6 Lines Flat Field

As factory-set, the 148-M will generate a Full Field Signal and 3 lines of Flat Field, when that position of the FULL FIELD SIG Mode switch is selected. To generate Alternate Full Field Signals and 6 lines of Flat Field, move P430 from pins 2 & 3 to pins 1 & 3. This position allows the signal selected by the right hand FULL FIELD SIG Selector switch to be alternated with the signal selected by the left hand switch, followed by 6 lines of Flat Field (retaining the approximate APL percentage). See Fig. 2-6 for location of P430 on the Sync and Subcarrier circuit board.

Line and Field Selection

Vertical Interval Test Signals (VITS) may be selected to appear on lines 10/273 through 18/281 of fields 1 and 3, fields 2 and 4, or all fields. Line and Field selection is accomplished by selecting various internal quick-change pin connectors on the VITS and FF circuit board, see Fig.

2-7. An access door is provided so that VITS selection can be made without removing the top cover from the instrument.

Referring to the VITS and FF circuit board, notice that a rectangular matrix is used to select the Line and Field for each VITS. Two jumper plugs must be used to select the VITS; one for field selection, the other for line selection.

To prevent or disable a particular VITS, move the line jumper plug to the OFF position.

Each matrix row is color-coded to help identify its associated VIT Signals. This color code is listed in Table 2-3 and Fig. 2-7.

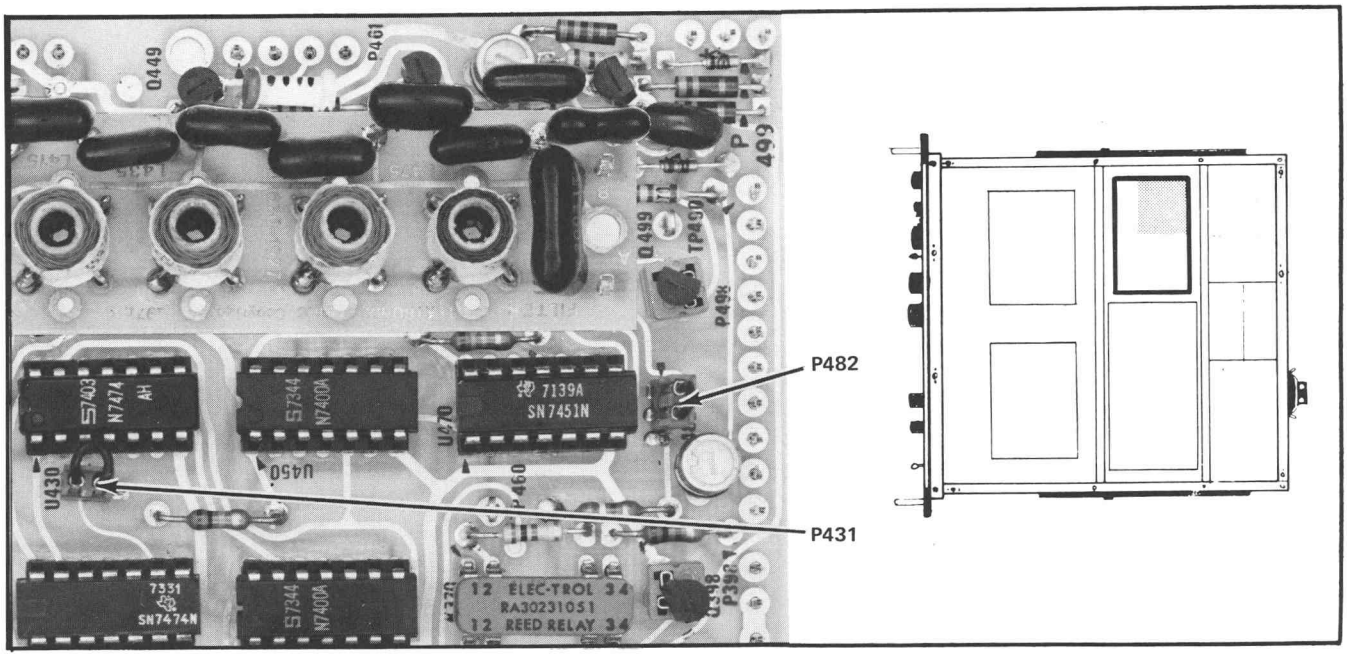


Fig. 2-6. Subcarrier and Sync circuit board showing location of P482, Full Field Burst; and P431, ALT & 6 LINES APL.

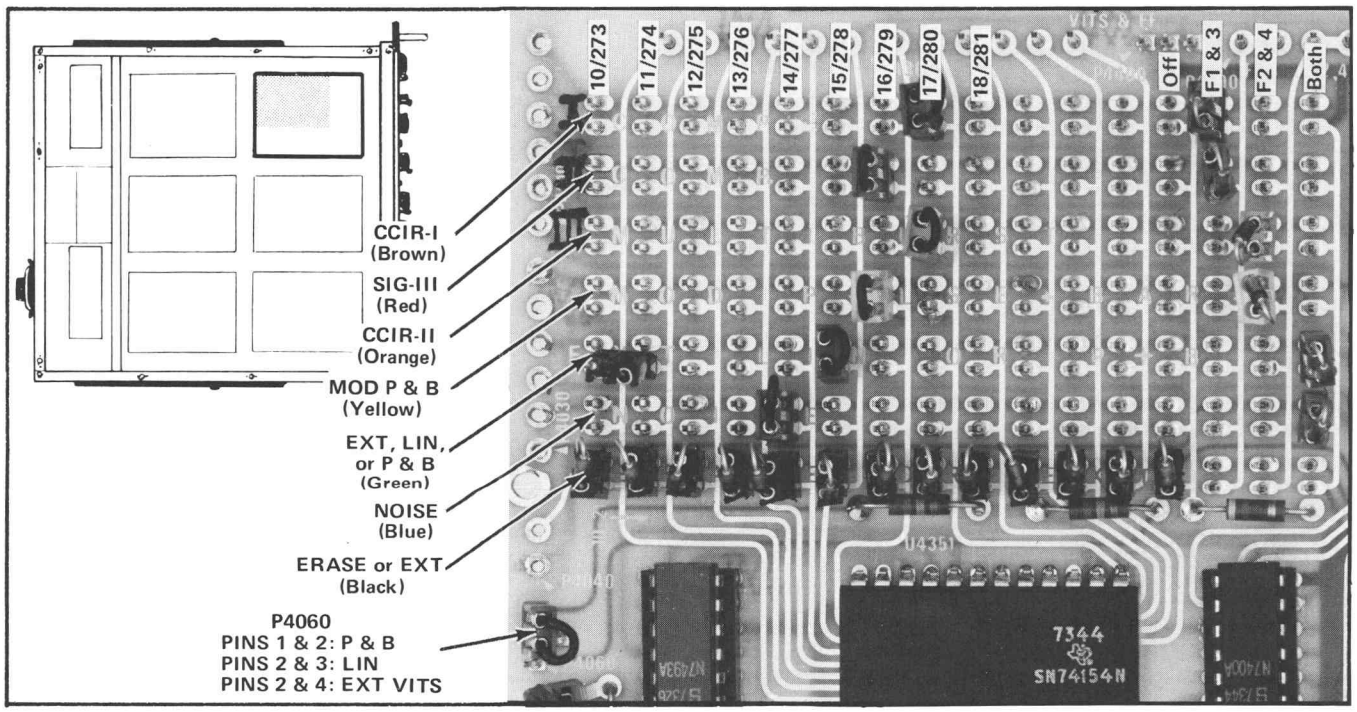


Fig. 2-7. VITS and FF circuit board showing locations of VITS Line and Field selector plugs; VITS Line and Field selection.

TABLE 2-3

VIT Signals	Connector Color
CCIR-I	Brown
SIG-III	Red
CCIR-II	Orange
MOD PULSE & BAR	Yellow
EXT, LIN, or P & B	Green
NOISE	Blue
ERASE	Black

Ext—Linearity—P & B

The operator may select any line from 10/273 through 18/281 of fields 1 and 3, fields 2 and 4, or all fields as follows:

LINEARITY—Pins 2 and 3 of P4060 must be connected.

P & B (Pulse & Bar)—Pins 1 and 2 of P4060 must be connected.

EXTERNAL—Pins 2 and 4 of P4060 must be connected. External VITS applied to rear-panel EXT VITS connector. External VITS only on above programmed line and fields.

NOTE

Any signal applied to EXT VITS IN will add to internally programmed signals if inserted on same line(s).

If sync and burst are present at EXT VITS IN they will add to PREVIEW outputs in AUX and BYPASS. They will also add to FULL FIELD SIGNAL OUT, and PROGRAM LINE OUT (if there is loss of PROGRAM IN).

Erase

Any incoming VIT Signals may be erased (deleted) by the 148-M in the Erase mode. As factory-programmed, incoming VITS on the PROGRAM LINE IN will be deleted only if a 148-M VIT Signal is programmed for the same line and field. To erase incoming VITS that are not already being deleted, connect one of the spare Erase jumpers (cathode inboard) to the desired field and line selection pins in the Erase matrix. Any incoming VITS on the selected field(s) will be erased. To allow a particular VITS to pass, while erasing other incoming VITS, remove (or reverse) the Erase jumper from the matrix line selected. (See Fig. 2-7.)

2T/T Sine-Squared Pulse

As shipped from the factory, the 148-M generates the 2T Pulse. To display the T Pulse in place of the 2T Pulse, (1) change the connector on pins 1 and 2 of P7131 to pins 2 and 3, and (2) change the connector on pins 5 and 6 of P7321 to pins 4 and 5. (P7131 and P7321 are located on Output circuit board, see Fig. 2-8.)

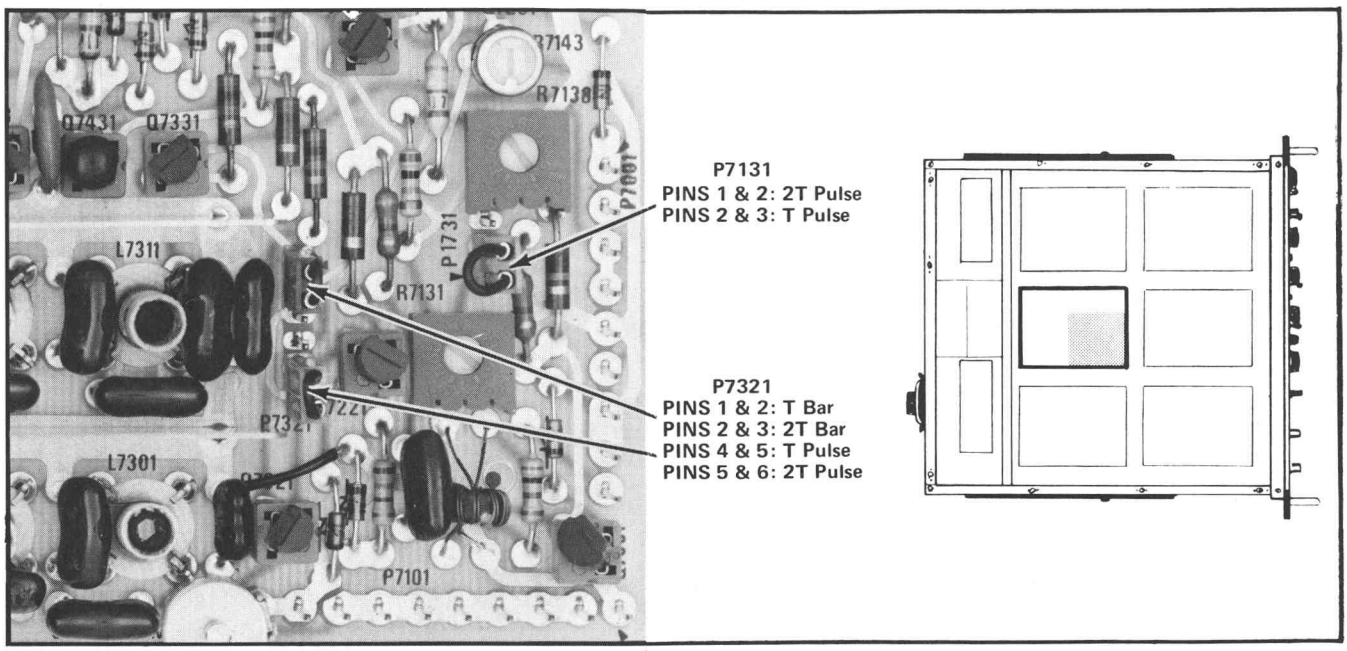


Fig. 2-8. Output circuit board showing locations of P7131 and P7321; 2T/T sine-squared Pulse and T/2T Bar (Integrated Sine-Squared Pulse).

T/2T Bar (Integrated Sine-Squared Pulse)

As shipped from the factory, the 148-M generates the T Bar. To display the 2T Bar in place of the T Bar, change the connector on pins 1 and 2 of P7321 to pins 2 and 3.

Field Sweep Markers

The FIELD RATE SWEEP GEN signal has 7 markers per field, as factory-shipped. To get 3 markers per field, move P1031 so that pin 1 of the connector goes to pin 2 on the circuit board. (See Fig. 2-9.)

Gen-Lock, Burst or CW (Residual Subcarrier)

As shipped from the factory, the 148-M will Gen-Lock to signals containing composite sync with subcarrier present during the burst time interval. In this mode, sound-in-sync will not affect lock.

If desired, the 148-M may be programmed to lock to burst, in the presence of residual subcarrier, without phase shift due to residual subcarrier. This mode should not be used in the presence of sound-in-syncs since the 148-M system uses residual subcarrier at sync time as a reference. Change the connector on pins 2 and 3 of P5150 to pins 1 and 2. (P5150 is located on Gen-Lock circuit board, see Fig. 2-10.)

Horizontal Programming

The 148-M test signal components, shown in Fig. 1-2, and detailed in Table 2-4, are timed by the digital programmer on the Horizontal Timing circuit board. The programmer consists of 32 columns of pin connectors, each column corresponding to a characteristic instant. The characteristic instants are spaced at 2 μs intervals. The exact spacing is $\frac{63.56\ \mu s}{32} = 1.98625\ \mu s$.)

All wires and connectors which program the 148-M are color coded. (See Fig. 2-11.)

It is possible to reprogram the 148-M to provide test signals with components occuring at selected times. Assume that a user wishes to program the STOC-TV[2] recommended composite signal in place of the CCIR-I composite signal. (See Fig. 2-12.) This signal differs from the CCIR-I signal by placing the Modulated Staircase at the start of the line, and the Bar at the end of the line. The user should determine the characteristic instants that correspond to the functions to be programmed. These instants can be written down in the Instant Timing column of Table 2-4, next to the original timing, for a record of the change. For all components of the new signal, find the program wire of the original signal, and move it to the new instant. For example, to program the Bar portion, move the Set wire (red connector, 9-6 wire) from instant 6 to instant 21. Move the Reset wire (black connector 9-06 wire) from instant 15 to instant 31. Using Table 2-4 and Fig. 2-12 as guides, the rest of the signal, and many other combinations can be programmed.

[2]**Satellite Technical and Operational Committee—Television**

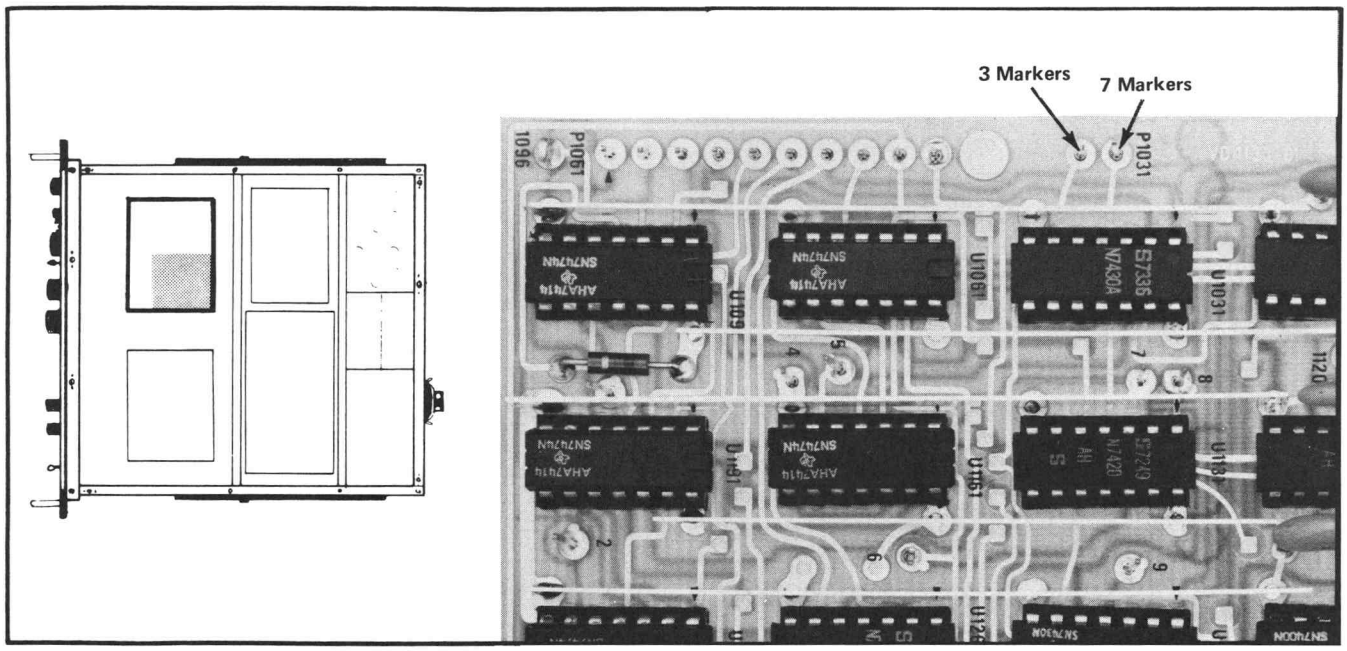


Fig. 2-9. Horizontal and Vertical Counter circuit board showing location of P1031; Field Sweep markers.

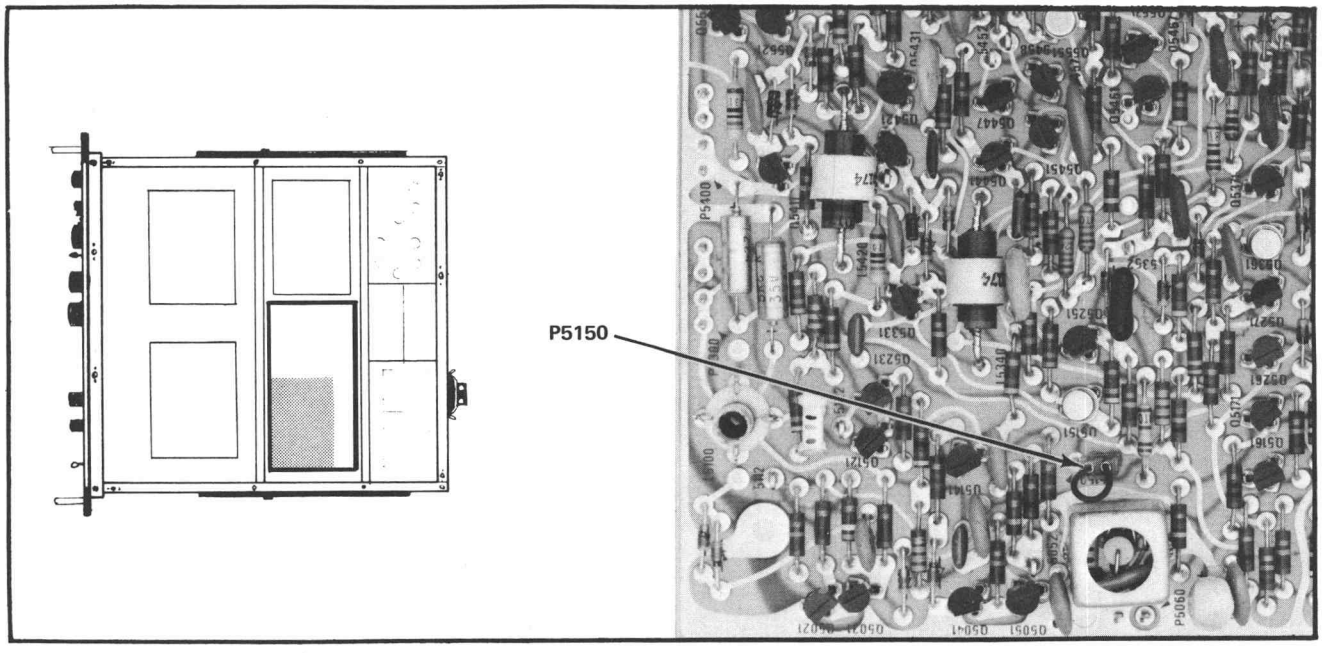


Fig. 2-10. Gen Lock circuit board showing location of P5150; Genlock Burst or CW (Residual Subcarrier).

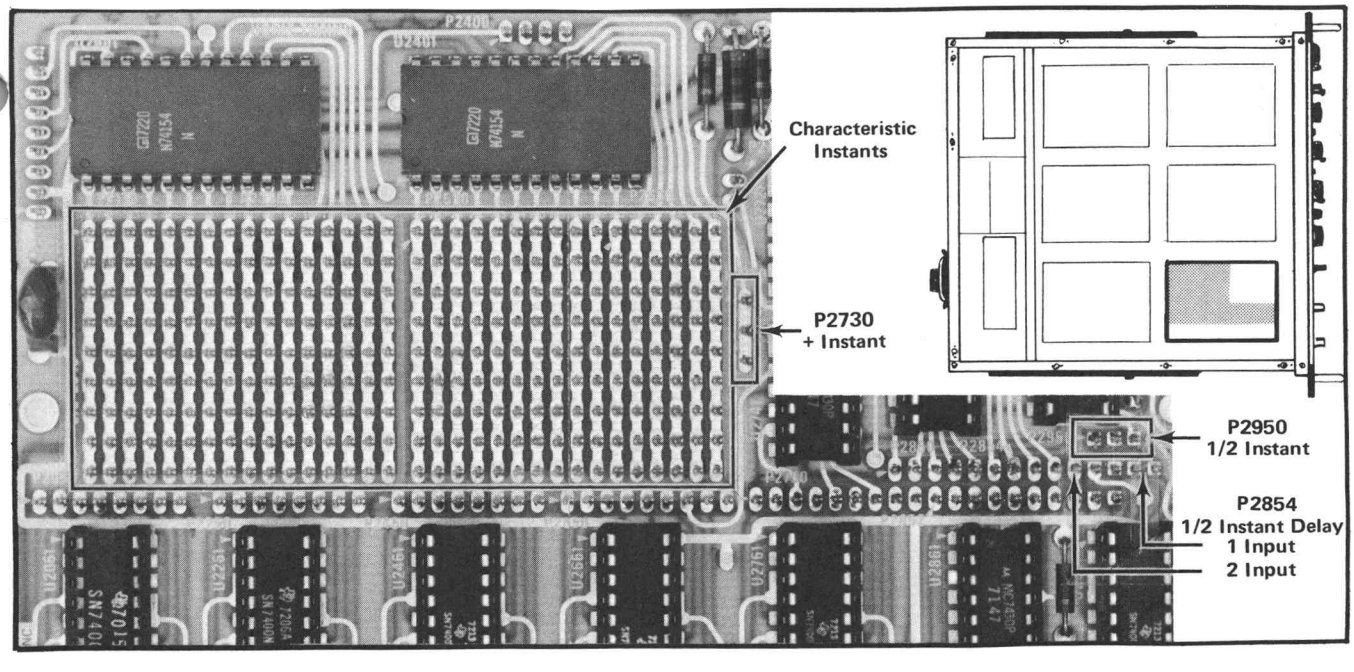
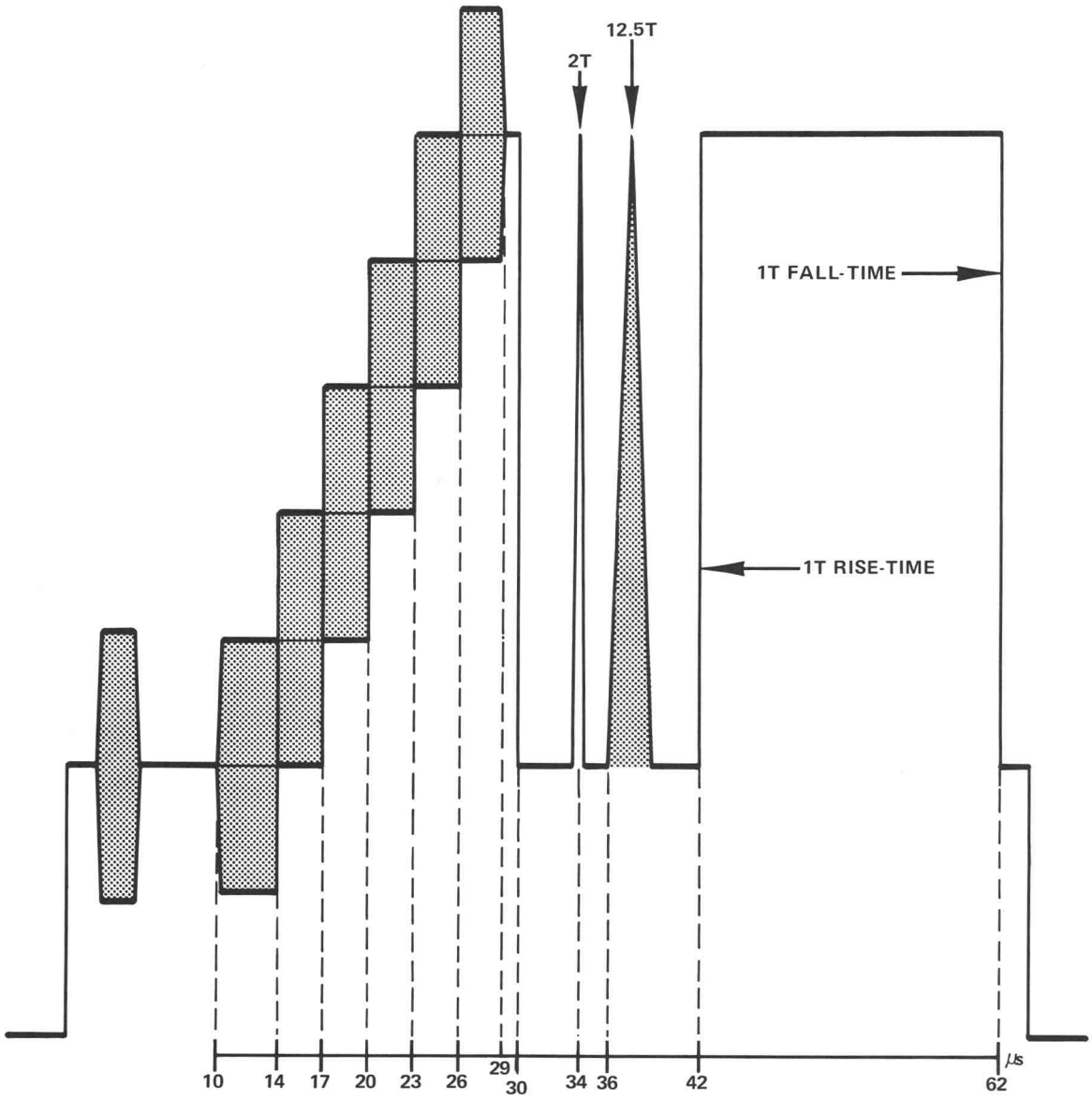


Fig. 2-11. Horizontal Timing circuit board showing locations of Characteristic Instants (use with Table 2-4); Horizontal Programming.



(a) Approximate STOC-TV composite signal timing.

CCIR-I	Step Enable	Set	0	22	5
		Reset	3	31	15
	5 Step— 1st level	Set	1	23	7
	2nd level	Set	1	24*	8
	3rd level	Set	0	26	10
	4th level	Set	2	27*	11
	5th level	Set	3	29	13
	Pulse	Set	1	17	Same
	Bar	Set	2	6	21
		Reset	0	15	31
	Mod Pulse	Set	0	18	Same
		Reset	0	19	Same
CCIR-I (only)	Modulation	Set	0	21	5
		Reset	3	30*	14

STOC Programming

(b) Section of Table 2-4 showing notations for new signal timing.

Fig. 2-12. Sample, showing how to reprogram the 148-M horizontal timing, with suggested method of recording the change.

TABLE 2-4

Factory Horizontal Programming

Signal	Affected Portion	Function	Connector Color Code	Timing Instant	Key To Table Instant	Wires
All,	H Blanking	Set	0	6	1	9-1
		Reset	0	31	2	9-2
LINEARITY	10 Step-1st level	Set	3	9	3	9-3
	2nd level	Set	0	11	4	9-4
	3rd level	Set	0	13	5	9-5
	4th level	Set	1	15	6	9-6
	5th level	Set	0	17	7	9-7
	6th level	Set	1	19	8	9-8
	7th level	Set	1	21	9	9-0
	8th level	Set	2	23	10	9-01
	9th level	Set	1	25	11	9-02
	10th level	Set	1	27	12	9-03
	Modulation	Set	0	5	13	9-04
		Reset	4	29	14	9-05
	Ramp	Set	0	9	15	9-06
		Reset	0	28	16	9-07
					17	9-08
					18	9-12
CCIR-I	Step Enable	Set	0	22	19	9-13
and		Reset	3	31	20	9-14
SIG-III	5 Step- 1st level	Set	1	23	21	9-15
	2nd level	Set	1	24	22	9-16
	3rd level	Set	0	26	23	9-17
	4th level	Set	2	27[3]	24	9-18
	5th level	Set	3	29	25	9-23
	Pulse	Set	1	17	26	2-24
	Bar	Set	2	6	27	9-25
		Reset	0	15	28	9-26
	Mod Pulse	Set	0	18	29	9-27
		Reset	0	19	30	9-28
					31	9-34
CCIR-I (only)	Modulation	Set	0	21	32/0	9-35
		Reset	3	30[3]		

Color	Code
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray
9	White

CCIR-II	Multiburst White Ref.	Set	1	6		
		Reset	0	8		
	350 mV Pedestal	Set	1	8		
		Reset	1	31		
	0.5 MHz	Set	2	9		
		Set	1	12		
		Reset	0	14		
	2.0 MHz	Set	1	14		
		Reset	2	16		
	3.0 MHz	Set	3	16		
		Reset	1	18		
	3.57 MHz	Set	2	18		
		Reset	0	20		
	4.2 MHz	Set	1	20		
		Reset	2	31		
	1st Chroma level	Set	0	23		
		Reset	0	30		
	2nd Chroma Level	Set	0	25		
		Reset	1	30		
	3rd Chroma Level	Set	0	27		
		Reset	2	30		

Example: A wire connected to INSTANT 24 has a color code of 9-18 and is read, BROWN-GRAY on WHITE. If this wire is the only connection to INSTANT 24, it will have a black connector. The second wire to INSTANT 24 will be 9-18/1 and read, BROWN-GRAY on WHITE with BROWN connector.

[3]**Actual timing of output signals will be delayed 1/2 instant.**

TABLE 2-4 (cont)

Factory Horizontal Programming

Signal	Affected Portion	Function	Connector Color Code	Timing Instant	Key To Table	
					Instant	Wires
PULSE & BAR	Pulse	Set	1	11		
	Var	Set	1	16		
		Reset	1	29		
	Mod Pulse (Disabled)	Set	4	[4]		
		Reset	1	9		
FIELD RATE SWEEP GEN	Modulation Enable	Set	0	7		
		Reset	2	29		
MOD PULSE & BAR	Modulated Pulse	Set	2	8		
	Modulated Bar	Set	0	16		
		Reset	0	29		
NOISE	1/2 Line Insert	Set	0	12		
		Reset	0	24		
SPARE	(Unused outputs)	Set	3	8		
		Reset	0	10		

[4]**The Mod Pulse may be enabled by removing the connector from P2730-2 and connecting it to instant 8.**

@

CIRCUIT DESCRIPTION

General

This section of your manual describes the electrical operation of circuits within the 148-M. The description is organized with respect to the schematic diagrams.

The 148-M can be considered as in Fig. 3-1. Basically, the 148-M consists of (1) A relay to provide bypass in the event of loss of power or when the instrument is in the bypass or auxiliary modes, (2) Sync and Subcarrier processing circuits to detect synchronization information, (3) Timing circuits to provide gate signals used for generation of the output signals, (4) Test Signal Generator to generate the various output signals, (5) Program Control Switching to allow the operator to select the mode of operation, (6) Electronic Switches to route all signals to the proper outputs at the proper time, and (7) Output Amplifiers to provide sufficient current to drive the outputs.

Block Diagram

The block diagram relates the schematic circuitry to the operation of the 148-M, and is a transition between Fig. 3-1 and the schematic diagrams.

DIAGRAM ◈ a and ◈ b

The circuitry shown on Diagram 0_a (Program Line Amplifier) is used to condition the input signal applied to the PROGRAM INPUT for further processing (required for insertion of signals) and selects the mode of operation. The circuitry shown on Diagram 0_b (VITS Inserter) routes both internally generated and externally applied signals during selected intervals so that a composite of each is available at the PROGRAM OUTPUT LINE, PROGRAM MONITOR OUTPUT, or PREVIEW OUTPUT connectors.

Relay

The relay circuitry is used to bypass the program signal to the PROGRAM OUTPUT LINE in the event of circuit failure, loss of power, etc., or apply the program signal to the active circuits within the 148-M for processing.

Bypass Indicator

This stage, consisting of emitter follower Q580, detects the condition of the bypass relay. The output of Q580 will be at or near ground when the relay is energized. The output will be around +5 volts if the relay is not energized. This information is used for three purposes. First, the output, which goes to U761-6, turns off the program switch and prevents any signal from entering the program output amplifier. This ensures that there is no signal present on the open contacts of the bypass relay that might cause crosstalk into the program lines. Secondly, the output of this stage is used, as shown on Diagram 4, to operate the bypass indicator lamp. The third use of this signal relates to the auxiliary mode of operation. In this mode of operation the timesharing of the internally generated signals and the incoming signals is reversed. A high output from the Bypass Indicator stage enables U4381A to reverse the VITS Key timing.

Program Amplifier

The Amplifier stage is an ac coupled operational amplifier with unity gain or variable gain (front-panel LEVEL) of the program signal. Coupling Capacitor C520 removes any dc component that may be applied via the PROGRAM LINE IN.

Q540 provides constant current for emitter-coupled amplifier Q510-Q520. Current through Q520, set by R9205 (LEVEL) or R505 (dependent upon the setting of S9205, UNITY GAIN/VAR), flows through R625 (Rf of operational amplifier Q620-Q630) to set the overall circuit gain. The signal at TP820 is applied to the VITS switches (after dc restoration). R720 and CR720 balance out any residual differential phase that may be present in the program amplifier. CR720 is installed either forward or backward, depending on the nature of the differential phase that is present. Refer to the Calibration Procedure for further information.

Back Porch Gate Generator

The stage is used to generate a pulse during back porch time to drive the Back Porch Clamp circuitry.

Q905, normally on, is driven by composite sync (negative-going). On the trailing edge of each sync pulse, Q905 turns off (current shunted via Q900), producing a pulse that is differentiated by C910 and R926. When Q905 turns back on, the differentiated pulse turns Q920 (normally on) off. A negative-going pulse, which has been delayed from sync, is obtained at the collector of Q920,

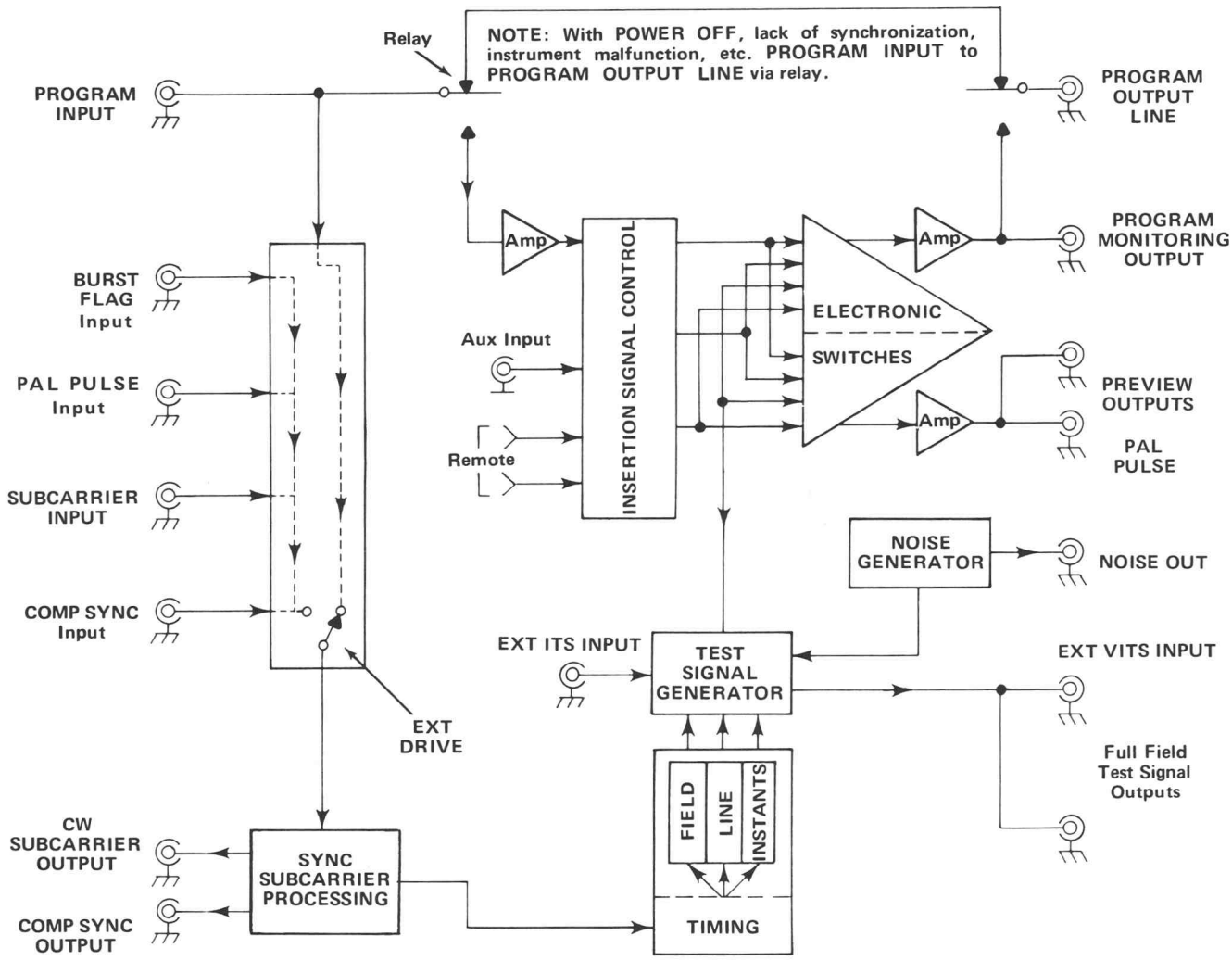


Fig. 3-1. Basic block diagram of the 148-M.

such that during back porch time, the circuit dc-restores the signal appearing at TP801. The pulse-forming circuitry acts like two monostable multivibrators. The first one, consisting of Q900 and Q905, forms the delaying time necessary following the trailing edge of sync. The second monostable consists of Q905 and Q920; it forms the actual clamping pulse.

Back Porch Clamp

Q820 is the active circuit element of this stage. During back porch time, it is biased on and effectively grounds TP801. This dc-restores the signal via C804 in the amplifier stage.

Program Control Switching

Consisting of S9212 and S9213, this stage selects the mode of operation: PROGRAM, PREVIEW, or BYPASS, and REMOTE, AUX, or LOCAL.

VITS Switches

U761 and U861 are used to route the program signal (or auxiliary signal in AUXILIARY mode) to the Output Amplifiers, except when VITS is inserted during the vertical interval. During VITS time, the switches route internally generated signals to the Output Amplifiers as programmed VITS.

Basically, the circuitry acts like two double-pole double-throw switches. In one position, signals applied to pins 2 and 15 reach the differential output, pins 12 and 13. In the other position, signals at pins 7 and 10 reach the output. Switching between the two channels of each switch is dependent upon the condition of pin 4. Signals reaching the output of each switch are also dependent upon the condition of pin 6 (if high, no output will be obtained). Thus, the incoming program signal (or auxiliary) is applied to one channel, the internal signal to the other; dependent upon Program Control Switch settings, a combined output is obtained.

VITS Switch Control

As discussed above, VITS switching is dependent upon the condition of U761 pin 4 and U861 pin 4. The VITS Switch Control stage is used to steer a control signal to pin 4 of each switch so that insertion may occur. Q560, Q570, and Q658 are the active elements of this stage.

For the discussion that follows, assume that the PREVIEW mode of operation is selected, and that VITS is internally programmed to appear during the vertical interval. Under these conditions, the signal at the PROGRAM OUTPUT LINE and MONITORING OUTPUT is the same signal applied to the PROGRAM INPUT; the signal at the PREVIEW OUTPUTS is the PROGRAM INPUT signal, plus the internally generated and inserted VITS. For these conditions to exist, pin 4 of U761 (program switch) must be held low at all times to inhibit insertion in the program channel. That is, in the preview mode of operation the VITS key signal should be steered into the preview switch and away from the program switch. In addition, pin 4 of U861 (preview switch) must be held low, except during VITS time.

S9212 places a ground on P591-6. CR585 and CR588 are forward biased, shutting off Q560 and Q658. With Q560 and Q570 off, pin 4 of each VITS gate is low and only the program signal appears at the respective outputs. During VITS time, a VITS key pulse (via P591-3) reverse biases CR588 to switch current through Q570. Pin 4 of U861 goes high, allowing the VITS (via pin 7 of U861) signal to be routed to the PREVIEW OUTPUTS.

In the PROGRAM mode, it is desired to steer the VITS key signal to both the program switch and the preview switch. In this mode, the ground is removed from P591-6. Q560 therefore is able to conduct, but its collector does not go positive because Q658 is biased on during the low state of the VITS key signal. When the VITS key signal goes positive and cuts off CR588, current flows through Q570. This places a high state voltage on pin 4 of U861 (the preview switch) and through CR664 to the base of Q658, which acts as an emitter follower to deliver the high state voltage to pin 4 of U761. Therefore, both the program switch and the preview switch are furnished with the VITS key signal, and Insertion Test Signals will be seen at the PROGRAM OUTPUT LINE and the PREVIEW OUTPUTS.

Should interruption of the program signal occur, a detector elsewhere in the instrument senses the absence of an incoming signal and at that time develops a high state voltage, which is delivered to P501-2 by way of CR651. This signal cuts off Q658, thus allowing the current through Q650 to hold a high state voltage on pin 4 of U761. This steers the internally generated full field test signal into U761; whichever full field test signal has been selected on the front panel will then appear at the program output. The link from the program loss sensing circuit to P501-2 passes through the remote plug on the rear of the instrument. If this feature is not desired, the connecting jumper may be removed.

Output Amplifiers

The outputs of both U761 and U861 are push-pull signals. Each output amplifier consists of a differential pair followed by a feedback operational amplifier. The differential pair converts the push-pull signal from the program or preview switch to a current. This current drives the input summing junction of the operational amplifier. R868 and R978 (Rf for the two amplifiers) set the gain of each stage. These operational amplifiers provide the low impedance necessary to drive the PROGRAM OUTPUT LINE, MONITORING OUTPUT, and PREVIEW OUTPUTS.

Preview Indicator

Q565, an emitter follower, provides drive for the PROGRAM and PREVIEW lamps.

DIAGRAM ① a and ① b

The Vertical and Horizontal Counter circuitry synchronizes the 148-M to the incoming program composite sync (or black burst), and generates all timing signals required for operation of the 148-M.

Horizontal Integrator, AFC Sampler, 1 MHz Oscillator, Divide-By-64 Counter, and Delayed Feedback

A 1 MHz oscillator generates a pulse that is counted down to the line rate. The line-rate gate is then compared to the external composite sync. Any timing error between these two signals will produce an error voltage to change the oscillator frequency. This action keeps the ÷64 counter in step with the external sync.

1 MHz Oscillator. Q1691 and Q1791 are the active components for the 1 MHz oscillator. CR1740 and L1670 are the frequency-determining components. Sustaining feedback is provided via C1798 and C1995. The output of the oscillator at TP1480 consists of positive-going pulses (limited sinewaves), which are then used to toggle the Divide-by-64 Counters.

Divide-by-64 Counter. U1391 and U1361 are synchronous counters, connected for a divide-by-2, divide-by-4,..., divide-by-64 sequence. 1 MHz to the C_p inputs provides outputs at 32H, 16H, 8H, 4H, 2H, and H rates.

Delayed Feedback. U1461C combines three of the Divide-by-64 Counter outputs to produce a negative gate, approximately 8 μs wide, each horizontal line. During the 8 μs negative interval, this pulse disconnects CR1795 and turns off Q1991, which allows C1780 to charge towards +15 volts (from 0 volts) at an approximate rate of 0.5 V/μs. (Charge path via R1893 and R1760.)

The ramp voltage across C1780 is then compared against the setting of R9209 (INSERT DELAY) and R1988 (Sync Delay) by voltage comparator Q1731 and Q1741. When the ramp voltage exceeds the delay voltage, Q1731 is turned off and a ringing pulse is developed across L1850. This pulse is then peak-detected by CR1930 to drive the AFC Sampler.

AFC Sampler. Q1921 and Q1721 form the AFC Sampler. When Q1921 is turned on, Q1721 acts as a gate that allows the voltage obtained by the ramp in the Horizontal Integrator to be transferred to the variable capacitance diode CR1740, which controls the 1 MHz Oscillator.

Horizontal Integrator. During sync time, this stage produces a ramp that is sampled to control the 1 MHz Oscillator. Composite sync is coupled to switching pair Q1801-Q1811. This switch, during sync time, allows current determined by R1820 to charge C1902 via Q1811 and R1903. This produces a positive (approximately 3 V/μs) ramp, made linear by Q1911. At approximately 4.7 volts positive, Q1901 is saturated to clamp the ramp, preventing breakdown of Q1721 in the AFC Sampler circuit.

At the end of sync time, Q1801 is turned on, and current via R1810 causes the ramp at the emitter of Q1721 to go in a negative direction towards 0 volts at an approximate rate of 2.5 V/μs, made linear by Q1911. Ramp voltage at sample time is transferred via the AFC Sampler stage to the 1 MHz Oscillator, which brings the ÷64 Counter into step with the external sync.

VITS H Blanking

U1331B and U1461A combine the various timing signals from the Divide-by-64 Counter so that U1301A provides the required horizontal blanking that is used to gate (switch) the VIT Signals into the program signal during VITS time.

Vertical Integrator

The vertical integrator produces a ramp during the vertical serration pulses, which is then peak-detected and used to set the Field Counter and Field Recognition circuits. This integrator is similar to the horizontal integrator except for circuit values.

Peak Detector

On the last vertical serration pulse, Q1411 is biased on, producing one negative vertical reset pulse per field to drive the Field Counter and Field Recognition circuit.

Field Recognition

U1301B has square-wave outputs that are used for selecting VITS fields. The clock input, pin 11, receives a six and one-half line wide, field-rate pulse from the divide-by-525 counter. The data (D) input, pin 12, gets an inverted 8 μs wide, line-rate pulse from the divide-by-64 counter. If the data input is high when the clock pulse goes high, pin 9 will go high. This condition occurs at the start of fields 1 & 3. At the start of fields 2 & 4, the data input is low when the clock pulse goes high, so pin 9 switches low. See Fig. 3-2 for timing diagrams.

Clock

This stage (U1461B) is driven by pulses corresponding to instants 15 and 31 (see Operating Instructions or diagram 2_a for details). The pulses are used to toggle the Divide-By-525 Counter.

Divide-By-525 Counter

The counter generates the various timing gates required for one-half line offset used in interlace scanning. The counter is initially set to a count of 499 by a pulse obtained in the Vertical Integrator. It is then toggled from the Clock stage, counting to 1024 in a divide-by-2, divide-by-4,...., divide-by-1024 sequence. On the 1024 count, the counter is reset to a count of 499 and the sequence is repeated. (1024 − 499 = 525.)

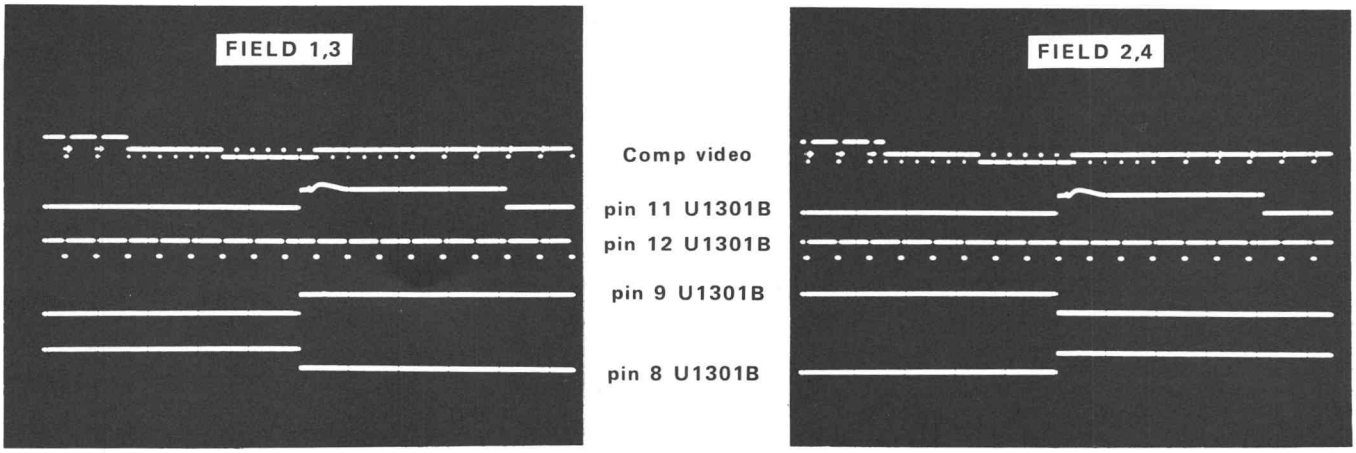


Fig. 3-2. Field Recognition timing waveforms.

Encoder Matrix

The encoder matrix produces timing-gate pulses from the divide-by-525 counter signals. A typical circuit consists of a pair of gates a set-reset flip-flop. For example: The 9 Line Keyout signal is generated by U1031, U1331A, and U1201A & D. This signal is used to change sync timing during vertical sync time. The signal duration is from the start of line 523 until the end of line 6, and from the middle of line 260 to the middle of line 269. U1201A & D, a set-reset flip-flop, will change state when the first low is received at the set input. It won't change state again until a low is received at the reset input. U1031 provides the set enable when all of its inputs are first high. This happens at the start of line 523 and at the middle of line 260. U1331A provides the reset enable when all of its inputs are first high. This occurs at the end of line 6, and at the middle of line 269.

Other signals generated by the encoder matrix are produced in the same way as the 9 Line Keyout. The Vertical Blanking signal duration is from the start of line 523 until the end of line 18, and from the middle of line 260 until the middle of line 281. The Field Sq. Wave signal occurs from the start of line 74 until the end of line 206, and from the start of line 337 until the end of line 469. This is a 60 Hz squarewave with about 50% duty cycle. The Pulse & Bar signal, Bar Enable, occurs between the start of line 63 and the end of line 216, and from the start of line 326 until the end of line 478.

DIAGRAM ② a and ② b

The Horizontal Timing circuitry combines the various signals generated by the Vertical and Horizontal Counters into timing pulses required to generate all test signals.

Instant Decoder

U2001 and U2401 are used to decode the various outputs from the Divide-By-64 Counter. Decoding provides 32 outputs (characteristic instants) about 2 μs apart,

$$\frac{63.56\ \mu s}{32} = 1.98625\ \mu s$$

each having a 1 μs negative-going pulse once each line.

Set-Reset Circuits

There are twenty-three set-reset circuits available on the Horizontal Timing board. The event associated with any given set-reset circuit is labled on Diagram 2_a and 2_b directly above the row of connectors that carry the input signals to the set-reset circuits.

Each set-reset circuit is programmed in the instant decoder matrix. The characteristic instant associated with the command, e.g. set or reset, is indicated above the input signal line. The times indicated are factory programmed.

Multiburst Width

This stage enables the Multiburst generator. U2741 senses low inputs to the various burst R-S flip-flops and triggers the monostable multivibrator U2811A. Pins 3 and 4 of U2811A are negative-edge sensitive when pin 5 is enabled by a high from Diagram 4. U2931C provides negative triggers during every horizontal line, but a high enable from Diagram 4 occurs only on the line and field that are programmed on the VITS line and field matrix. C2730, R2715, and R2720 are the timing components for U2811A. The low output pulse at U2811A and pin 1 is inverted by U2911B, a low input OR gate.

LINEARITY Staircase Logic

The full line linearity signal can be either a 10 step or a 5 step staircase or a ramp. The timing information for this signal is developed from the characteristic instant matrix and delivered to the inputs of OR gates U2831 and U2961C. Each characteristic instant corresponds to a riser on the 10 step staircase. The timing information for the 5 Step staircase signal is derived from the 10 Step timing information through the use of a divide-by-2 counter located on the Staircase circuit board.

1/2 Instant Delay

This stage, consisting of U2931E and U2961D, is used to delay characteristic instants 1 μs. (Factory connected for use with the CCIR-I and SIG-III signals.)

U2931E and U2961D invert negative-going (or low level) pulses from the Instant Decoder. The inverted (positive-going or high level) pulses are differentiated by C2936 or C2958. The negative-going portion of the inverted pulse is thus delayed 1 μs from the negative-going edge of the characteristic instant.

Modulation Logic

This stage provides a pulse that enables modulation to be inserted on the LINEARITY test signal or CCIR-I signal. U2981A generates a low enable output when pin 3 senses a high LINEARITY enable and pin 2 senses a high from the LIN MOD R-S flip-flop.

U2981B generates a low enable output when pin 6 senses a high CCIR-I/SIG-III enable from U2931D and pin 5 senses a high from the CCIR-I MOD R-S flip-flop.

Staircase Logic

This stage provides the timing necessary for the staircase portion of the CCIR-I SIGNAL or the SIG-III SIGNAL.

U2981C generates a low enable output when pin 9 senses a high CCIR-I/SIG-III enable and pin 8 senses a high from the CCIR-I/SIG-III LIN R-S flip-flop.

CCIR-I/SIG-III Five Step Timing

OR gate U2861 senses 5 characteristic instant inputs. Each of these instants corresponds to the time of a riser in the staircase signal used on both the CCIR-I and SIG-III test signals.

Pulse Timing

This circuit provides pulse timing for the T and 2T pulses used on the CCIR-I and SIG-III test signals and the PULSE & BAR full field test signal.

U2721 is 8an AND/OR gate. Pin 8 goes high when pin 9 or 10 and pin 13 or 1 are low. Pin 10 is low for CCIR-I or SIG-III, and pin 1 is low for PULSE & BAR. Pins 9 and 13 sense lows at characteristic times 11 and 17.

U2931F inverts the output from U2721 pin 8 to provide a low output.

Mod Pulse Timing

This stage provides the timing pulses required for the modulated sine-squared pulse. U2721 provides a high enable output to Diagram 9_b at pin 6. Operation of the AND/OR invert gate is similar to the pulse timing circuit.

Bar Timing

This stage provides the switching pulse for the bar, either T or 2T.

U2911A generates a low enable output on pin 1 when pins 2 and 3 are both high. Pin 2 senses a high from the P & B Bar Timing set-reset multivibrator on Diagram 2_a.Pin 3 senses a high for PULSE & BAR full field signal, or for PULSE & BAR/VIT Signal.

U2911C generates a low enable output for CCIR-I/SIG-III insertion test signal. Pin 8 is high for CCIR-I/SIG-III, and pin 9 senses a high from the CCIR-I/SIG-III BAR R-S flip-flop.

DIAGRAM 3 a and 3 b

The circuitry on Diagram 3_a and 3_b is used to generate and amplify the NOISE test signal and to generate the LINEARITY and FLAT FIELD test signals.

Noise Generator

This stage uses the thermal characteristics of two resistors (R3285 and R3383) to generate the noise.

The generated noise amplitude (approximately 60 μV) may be computed using the formula: $e = \sqrt{4kTR\Delta f}$, where k = Boltzmann Constant, T = 300° K, R = parallel combination of R3285-R3383, and Δf = 5 MHz.

Noise Preamp

Q3360-Q3370 and Q3240-Q3250 are operational amplifiers, each having a gain of approximately 30, as determined by the ratio of R3271 to R3371, and R3341 to R3343, respectively. This provides approximately 70 mV of noise at the collector of Q3240. C3251 and R3270 affect the low frequency cutoff so that the noise spectrum is flat (within the tolerance listed in Section 1).

Noise Amplifier

This stage provides front-panel (NOISE LEVEL dB) dc control of the noise signal.

The 1 dB switch (S9240, located on the front panel) controls the current through the emitters of U3100A and B, which are connected as diodes. The impedance between pin 6 of U3100C and pin 9 of U3100D is set by this current. E.g., increased current reduces the impedance, and less signal is allowed to pass through the noise amplifier.

10 dB switch (S9235) provides a forward bias source for Q3040, Q3050, Q3060, and Q3070. Turning on one of these transistors grounds its collector. As these transistors are connected to a resistor string composed of R3141, R3163, R3171, and R3183, they set the impedance to ground at the base of Q3130. The amplitude of the signal seen by Q3130 is controlled by this impedance. Q3130 and Q3110 are emitter followers to provide low impedance outputs.

Field Square-Wave

This stage ensures that the Field Sq. Wave signal begins and ends at the beginning and end of horizontal lines in all 4 fields. The Field Sq. Wave signal input to this circuit comes from the matrix circuit on Diagram 1_b and is offset 1/2 line in fields 1 and 3.

U3585A is an edge-triggered D flip-flop. The data input (pin 2) is programmed by a high during lines 74 through 206 and 337 through 469, and a low during the remaining lines. Pin 3 is triggered by the positive portion of the H blanking signal from Diagram 8. The set and clear inputs are inhibited by +5 V through R3491. The output on pin 5 is the FIELD SQ. WAVE timing signal to the APL circuit.

Pulse & Bar

This circuit is similar to the Field Square-Wave, except that it's output is the PULSE & BAR/BAR ENABLE to Diagram 4, VITS and FF LOGIC. The data input of U3585B, (pin 12) is programmed by a signal high during lines 63 through 215, and 326 through 478.

Bounce Generator

This circuitry consists of a modified Bowes Oscillator (Q3890 and Q3880), which is front-panel controlled (RATE). This allows the oscillator period to be changed from ≈1 to greater than 10 seconds. The output of the bounce oscillator is used to control the data input of flip-flop U3855B. This flip-flop is clocked by horizontal blanking, so that the bounce transitions will take place coincident with the start of a line. The outputs of this flip-flop are used to control NAND gates U3835D and U3735C.

APL

This stage consists of four current switches that set the level of the FLAT FIELD or FIELD SQ WAVE test signal. U3735D produces a low output when FLAT FIELD ENABLE and H BLANKING (pins 12 and 13) are both high, disconnecting CR3921, CR3821, and CR3723. This permits current from Q3825, Q3820, or Q3720 to flow through CR3911, CR3811, or CR3711, and through R3814 to circuits shown on Diagram 7_a. Q3825 sets BLACK current when the output from U3835D is low, disconnecting CR3823. Q3820 sets WHITE current when the output from U3735C is low, disconnecting CR3725. Q3720 sets VAR current when S9275 is in the VAR APL position, disconnecting CR3721. A high output from U3735D shunts current from these transistors and disconnects CR3911, CR3811, and CR3711, disabling FLAT FIELD signals. Q3920 sets FIELD SQ WAVE current when pin 1 of P3801 is low, pin 8 of P3800 is low, and the output of U3835C is low. S9290 (% PEAK WHITE) selects the current setting resistors for FIELD SQ WAVE.

Linearity Modulation Amplitude

This stage is a programmable current switch (Q3420 and CR3411) that provides sufficient current to the modulator for either 140 mV or 100 mV subcarrier modulation on the LINEARITY test signal.

Control Logic

This stage combines timing and gate signals for the control of staircase and ramp generation for the LINEARITY and CCIR-I/SIG-III signals.

U3735A produces a low output on pin 3 to enable the integrator circuit when pins 1 and 2 are both high. U3735B produces a high output on pin 6 when either pin 5 is low for CCIR-I/SIG-III staircase or pin 4 is low for LINEARITY.

U3775A produces a negative-going pulse on pin 3 when pin 2 is high and pin 1 is pulsed high. U3755C inverts the low pulses from U3875C.

U3875C produces negative-going pulses when pin 8 or pin 9 senses positive pulses from circuits shown on Diagram 2_b. U3875B produces a high output on pin 4 when pin 5 of U3875B is low and S9253 is in the 10 STEP position, grounding pin 6.

U3775A produces positive-going pulses for either 5 STEP LINEARITY or CCIR-I/SIG-III signals. U3855A divides 10 STEP timing by 2 for 5 STEP LINEARITY. U3875A pin 1 is high to enable U3855A when pin 2 and 3 are both low.

U3835A produces a low on pin 3 for RAMP when pins 2 and 1 are both high. U3875D is high on pin 13 when pins 11 and 12 are both low (S9253 grounds pin 11 in RAMP position).

Integrator

This stage consists of a Miller Integrator and a reset circuit; it generates ramp and staircase waveforms.

The Integrator consists of Q3440, Q3430, and Q3530. C3441 and C3443 provide the feedback for integration.

The reset circuit consists of Q3520, Q3510, Q3600, Q3540, CR3531, and CR3533. When U3735A produces a low on pin 3, CR3533 conducts and disconnects CR3531. Q3520 increases conduction and shuts off Q3540. The integrator can now accept drive from either the 10 Step, 5 Step, or Ramp drive sources.

When Ramp is selected, a constant current is drawn from the Integrator input (gate of Q3440). As the gate of Q3440 is drawn positive, the source follows. Q3430 inverts and amplifies, initiating a negative ramp. Q3530 couples this negative excursion to feedback capacitors C3443 and C3441, and also provides a low impedance output.

When U3735A pin 3 goes positive, Q3520 shuts off, and Q3510 conducts, turning on Q3540. Q3540 conducts through CR3531, resetting the Integrator and disconnecting CR3533.

Q3600 clamps the base of Q3540 at +0.5 V. Feedback from the Integrator output to the emitter of Q3540 maintains the quiescent 0 V output level.

10 Step Drive

Each time U3775A pin 3 pulses low, Q3470 conducts and discharges C3470 and C3461 through Q3450. The current demanded by Q3450 drives the Integrator. For each pulse, a negative step is generated by the Integrator.

5 Step Drive

This circuit is similar to the 10 Step Drive circuit, except that C3565 and C3473 have a parallel capacitance twice that of C3470 and C3461, so that the 5 Step staircase is the same amplitude as the 10 Step staircase.

Ramp Drive

This circuit demands a dc current from the Integrator for Ramp generation. When U3835A pin 3 goes low, U3755D pin 8 goes high, disconnecting CR3651. R3616 and R3621 set the dc current demanded by Q3645 from the integrator, setting a linear ramp rate.

DIAGRAM ④

The circuits on Diagram 4 determine which lines will contain the test signals. Test signals may appear on all active lines, inwhich case it is referred to as a full field test signal; or they may occur on selected lines during the vertical blanking interval, in which case they are referred to as Vertical Interval Test Signals. The outputs from the circuitry on Diagram 4 are enabling signals directed to the individual test signal generating circuits.

Line Counter

The line counter establishes gating signals corresponding to each of the available VITS lines.

U4151 is a 4-bit binary counter. The trigger input is a characteristic instant pulse corresponding to time 0 and occurs once every line.

U4351 converts this binary code to decimal output. Both the G1 and G2 inputs must be low for U4351 to operate. The G2 input is connected directly to the vertical blanking signal, so that the decoded VITS line pulses will be present only during the vertical blanking interval. The G1 input is enabled by the VITS Nonsynchronous Inhibit circuit.

@

VITS Nonsynchronous Inhibit

This circuit prevents any VITS from being inserted into the vertical interval, should loss of vertical sync occur.

U4831B and C form a R-S flip-flop which, when set, produces a high output on pins 6 and 9 and a low output on pins 5 and 8. The high output enables the VITS Key circuit and the low output enables the G1 of U4351. When reset, these outputs are inverted (low on pins 6 and 9, high on pins 5 and 8), inhibiting the VITS Key and U4351.

Vertical blanking is capacitively coupled into the reset input (pin 10) through C4387 to inhibit the VITS line decoder at the start of every vertical blanking interval. A negative pulse from the Vertical Integrator shown on Diagram 1 sets the flip-flop when incoming vertical sync has been processed for the counters.

A LOW FOR NON SYNC from a circuit on Diagram 9_a appears at U4381C pin 10 when any incoming synchronizing signals are missing. This resets the flip-flop, and inhibits the Line Decoder and VITS Key.

VITS Line and Field Matrix

This stage selects lines and fields for insertion of the various VITS.

Each row of pin pairs corresponds to a particular test signal as labeled. Each column corresponds to a particular line. The 3 columns at the extreme right correspond to fields as labeled. Programming plugs placed on the matrix connect selected line and field information to AND gates U4621C, U4621D, U4621B, U4621A, U4641C, U4641D, and U4641A.

When one of the AND gates senses a low on both inputs (line on one, field on the other) the output goes high. The inverter makes this a low enable for the VITS Key and the VITS or Full Field circuit.

VITS Key

This circuit developes the SWITCH CONTROL signal for Diagram 0_b. A high output is present on pin 8 of U4581C when either pin 10 is low for AUX or pin 9 is low for insertion of test signals. A low output is generated by U4551D on pin 11 when U4551D pin 13 is high, U4551C pin 10 is high, and any input to U4821 is low.

Full Field Logic

This circuit provides for the front panel selection of full field test signals. The CCIR-I, SIG-III, CCIR-II, MOD PULSE & BAR, and LINEARITY test signal control methods are identical. For example, the control for the CCIR-I signal is as follows: U4881 pin 6 is high when pins 2 or 3, and pins 4 or 5 are low. Pins 3 and 4 are grounded (by FULL FIELD SIG switches S9260 and S9265) in the CCIR-I position. Pins 2 and 5 are switched high and low by the Alternate Switching Logic circuit on Diagram 9_b. U4851B generates a low enable output when pins 4 and 5 are both high.

The FIELD RATE SWEEP GEN test signal is controlled almost like those above, except the input to pin 10 of U4681 contains the logic for the field markers coming from the Field Rate Sweep Gen logic on Diagram 10.

U4741F and U4651B provide for BAR ENABLE and PULSE ENABLE signals for the full field signal, PULSE & BAR.

VITS or Full Field

This stage receives either low VITS timing pulses from the VITS Line and Field Matrix, or low full-field timing gates from the Full Field Logic circuit. Either input is inverted and passed on to the Control Logic circuit as a high.

Control Logic

This stage processes the enabling signals from the VITS or Full Field circuit and generates the required enabling signals for the test signal generators.

A low (enabling CCIR-I and SIG-III) appears on U4641B pin 4 when pin 5 or pin 6 is high. U4841C generates a high MOD INHIBIT on pin 8 when either pin 9 or pin 10 is low to shut off the Subcarrier Oscillator during the noise measurement mode. Pin 11 of U4841D produces a high MOD PULSE ϕ signal when either pin 12 or 13 is low. This high signal is then applied to the Subcarrier Phase Control circuit on Diagram 8 as an enable during modulated pulse time. U4741B inverts the high from U4651D for a low MOD PULSE & BAR ENABLE. PED and NOISE ENABLE is a low appearing on pin 6 of U4581B when pins 4 and 5 are high. U4841A produces a high BAR ENABLE when pin 1 is low or when pins 4 and 5 of U4841B are high. U4651A produces a high PULSE ENABLE when pin 1 is low or when pins 4 and 5 of U4651B are high.

Noise Logic

There are two modes of use for the 148-M noise measurement circuits. The first mode is deletion of any information on one full line of insertion test signal. This is useful where noise is to be measured at a downstream point, but incoming noise from upstream points is to be deleted. The second mode is the insertion of a meausred amount of noise on the center half of an insertion test line.

Deletion. When full line deletion is required, the desired line is programmed in the VITS Line and Field matrix. A positive-going pulse is then applied to pin 13 of U4581D, a high input and gate. S9225, the front panel NOISE switch, produces an open circuit at P4290-4, allowing U4581D pin 12 to go high through R4580. The resulting low at U4581D pin 11 causes a high at U4481B pin 6, which is then applied to U4481A pin 2. U4481A is a high input AND gate. U4481A pin 1 receives its required high when the vertical blanking signal is at a low state during the period. When U4481A pins 1 and 2 are both high, a low VITS Key is developed at pin 3.

Half Line Insertion. When a measured amount of noise is desired during the center portion of a particular insertion line, S9225 grounds pin 5 of U4281B. This inhibits the path just described and enables the path consisting of U4281B and U4481C. Pin 6 of U4281B must also be low which is the case when noise is called for as an insertion signal. The full field interval is unimportant in this mode since it is prevented from affecting the VITS key by the vertical blanking signal on pin 12 of U4481D. The output of U4281B is now seen to be a high applied to pin 9 of U4481C. Pin 10 of U4481C is high during the center portion of a scanning line, as determined by one of the set-reset circuits on Diagram 2_a. U4481C pin 8 will be low during the center portion of the desired VITS line. This ultimately generates a VITS Key of that same width. Other connections to S9225 ensure that noise is added in this second mode but not in the first, where deletion only is required.

Indicator Logic

This stage controls the operating mode indicator lamps on the front panel.

Two signal lines, labeled HIGH FOR AUX and LOW FOR PREVIEW control this circuit: When HIGH FOR AUX is high, Q4071 conducts, lighting the BYPASS indicator. When HIGH FOR AUX is low, U4281C is enabled. When LOW FOR PREVIEW goes low, U4281C generates a high on pin 10 and Q4091 will conduct, lighting the PREVIEW indicator. When LOW FOR PREVIEW is high, pin 10 of U4281C will be low, enabling U4281D. Q4081 conducts, lighting the PROGRAM indicator.

Auxiliary Logic

The auxiliary mode of operation requires that the VITS Key signal be essentially a composite blanking signal. The VITS switches shown on Diagram 0_b operate in such a fashion that the sync burst and blanking of the 148-M are added or mixed with the incoming auxiliary signal. U4831D combines vertical and horizontal blanking in order to produce a composite blanking signal applied to pin 1 of U4381A. Pin 2 of this gate is high when the front panel switch calls for the auxiliary mode. The desired VITS keying signal is therefore developed at pin 3 of U4381A.

DIAGRAM ⑤a

The Gen-Lock circuitry is used to provide reprocessed composite sync, and lock the internal 3.58 MHz oscillator to the incoming burst signal.

Sync Separator Circuit

The circuit removes sync from the externally applied composite video signal. Processing of the composite sync eliminates any degradation of the incoming composite sync, such as white noise, 60 Hz hum, etc.

Processing of composite sync is accomplished by clamping the sync tip level of the external composite video to a predetermined level, then adjusting the blanking level by controlling the overall circuit gain.

Fig. 3-3 is a block diagram of the Sync Separator circuit, and the description that follows is organized with respect to the block diagram and Diagram 5_a.

The sync tip of the external video signal (applied to the PROGRAM INPUT connector) is clamped at the sync tip level by the Sync Tip Comparator circuit, consisting of voltage comparator Q5371 and CR5480, operating as a current switch. The comparator is rate-limited and uses the dc-coupled sync to activate it. Once the comparator is switched, any tilt from the field or the line rate sync tips is eliminated. The rate limiting allows the feedback loop (through Q5481 and Q5287) to open at the trailing edge of the sync pulse, and makes the loop unresponsive to impulse noises. It also allows the Level Memory (C5288) to average the white noise on the sync tip during the time the loop is closed. This average determines the sync tip level.

The output from the Level Memory is applied to two filters. R5165 and C5063 form a high-pass filter that changes the gain of the summing amplifier from one (at very low frequencies) to a gain of three, above approximately 200 Hz. This variable gain feature allows fast recovery of the sync-tip level. In the feedback loop around Q5161 and Q5281 is a low-pass filter (C5186 and Q5171), that produces negative feedback to 60 Hz signals, effectively reducing 60 Hz hum.

The 50% Level Comparator (Q5271-CR5276) processes the sync at the 50% amplitude point between the sync tip level and the blanking level, ensuring correct sync width.

The Blanking Level Comparator (Q5261-CR5274) uses the difference in the duty factor between the sync pulse width and blanking width to determine the blanking level.

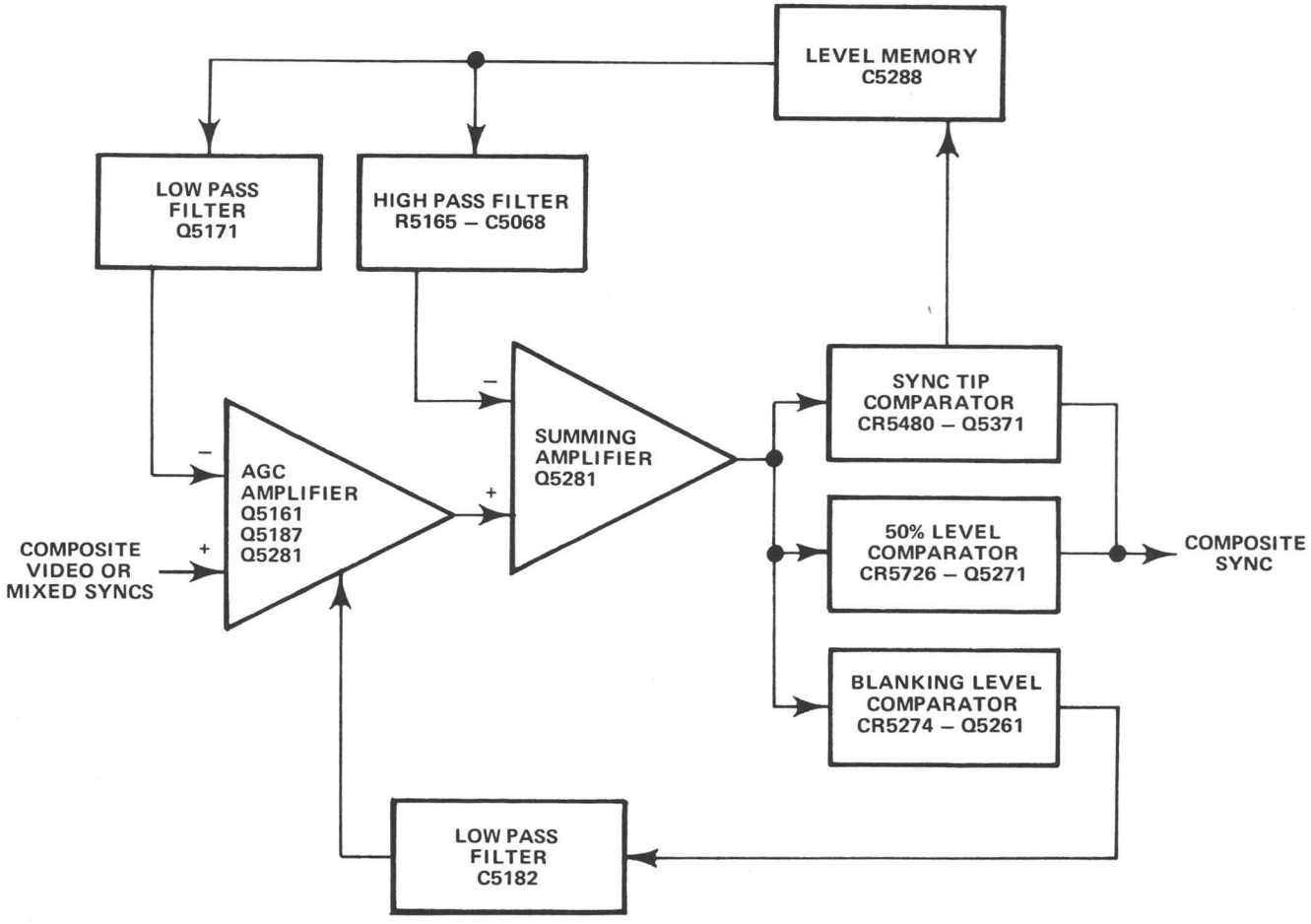


Fig. 3-3. Block diagram of the sync separator circuit.

This method allows the entire system to function because timing information is not required to close the AGC loop. The Low Pass Filter (C5182) averages the output of the Blanking Level Comparator; this voltage controls the overall system gain through Q5187. Q5181 and Q5091 provide quick-charge current for C5182.

Sound-In-Syncs Inhibit

This stage consisting of U5921A and B and U5967A, B, and C, is used to prevent sound-in-syncs from interfering with Gen-Lock. This is because the following circuit (Back Porch Generator) depends upon the trailing edge of sync; sound-in-syncs would cause the Back Porch Generator to operate during the sound-in-syncs pulse.

U5921A produces a pulse that has been delayed from the leading edge of sync. The pulse duration is longer than that of sound-in-syncs, but less than that of sync. This pulse ensures that the Back Porch Generator "sees" only the composite sync and not the sound-in-syncs.

Back Porch Gate Generator

The Gate Generator consists of Q5251 and Q5151. It provides gate pulses to the demodulators that correspond to the time of line sync and back porch, or the time of back porch only.

Negative-going composite sync pulses are applied to CR5258 via the Sync Separator circuit. CR5258 reverse-biases on the leading edge of the composite sync and C5257 charges towards −15 V through R5160. The charge path for C5257 is via Q5251 (normally on) and R5160. The trailing edge of the composite sync forward-biases CR5258, which couples a positive pulse through C5257 and turns Q5251 off, producing a series of negative-going pulses at the collector of Q5251. These pulses are coincident with the trailing edge of the line sync, the equalizing pulses, and the vertical sync pulses.

With P5150 in the BURST position (pins 1 and 2 connected), composite sync pulses via R5259 are added to the delayed pulses from Q5251 and drive Q5151. The

duration of each output (positive-going) pulse to the demodulators corresponds to the duration of the input line sync and back porch. With the BURST-CW jumper wire (P5150) in the CW position (pins 2 and 3), the output pulse duration to the demodulators corresponds to the time of back porch only.

Chroma Amplifier

The Chroma Amplifier consists of the Chroma Trap (C5055 and L5056) and three operational amplifiers in series with external AGC control.

Chroma Pickoff. The trap consists of a series resonant LC circuit (C5055 and L5056). The 3.58 MHz components of the signal, applied to the input, are separated from the external sync by the trap and applied to the Chroma Buffer Amplifier.

Chroma Buffer Amplifier. Q5051 and Q5041 are connected as an operational amplifier with low input impedance. The output (3.58 MHz subcarrier signal current) is regulated by the AGC circuit and applied to a second operational amplifier, Q5031-Q5021.

AGC Circuitry. The gain control circuit components include Q5141 and CR5040. This circuit regulates the subcarrier signal current (through CR5040 to the input of operational amplifier Q5031-Q5021) by shunting a portion of the signal current (at the junction of C5041 and C5043) through CR5040 to ground. The amount of current shunted through CR5040 depends on the current demand of Q5141. If the subcarrier signal current is excessive, an increased negative-going corrective signal from the AGC Comparator is applied to the base of Q5141. This increases the current through Q5141, which increases the current through CR5040. This decreases the impedance across the diode and shunts more of the signal current away from operational amplifier Q5031-Q5021, thereby decreasing signal input to the amplifier stage.

Limiting Amplifier. Q5031 and Q5021 are connected as a low input impedance operational amplifier with the feedback resistance (R5030) shunted by CR5010, CR5012, and C5034. This provides signal limiting to ensure that the subcarrier (due to peak signals) does not leak through the demodulator during non-demodulation time.

Output Amplifier. The output amplifier (Q5121-Q5231), an operational amplifier, ensures adequate drive current for the demodulators. L5100 is adjusted to compensate for subcarrier phase shift errors through the amplifiers.

DIAGRAM ⑤ b

Quadrature Demodulators

The Quadrature Demodulator circuits produce output signals (which correspond to the amplitude and phase of burst, if any, from the externally applied composite video signal) to control the internal master oscillator.

Demodulator Driver. Q5511, Q5521, Q5421, and Q5431 are connected as differential comparators. Q5511 and Q5421 are turned on and off, at the subcarrier rate, during line sync and back porch time (or back porch only) to provide switching current to the demodulators. Q5521 and Q5431 are driven by the internally generated subcarrier signal, with Q5521 operating 90° later than Q5431. Subcarrier delay is provided by L5610, C5625, and C5620. R5616 terminates the line. Quadrature shift allows burst demodulation in any quadrant (demodulation may take place between 0 and 360 degrees). Q5511 and Q5421 are driven simultaneously by the Back Porch Generator.

Quad Demodulators. Demodulators Q5331 and Q5411 are forward biased by Q5511 and Q5421 during non-demodulation time. External chrominance from the Chroma AGC Amp is therefore shunted to ground through Q5331 and Q5411. During demodulation time (burst time of the external chrominance signal), Q5331 and Q5411 are switched by the demodulator enable switch at the subcarrier rate. The demodulated chrominance signal is then applied to low-pass filters L5340-C5344 and L5421-C5432. The output of the filters is therefore a dc level that represents the phase and amplitude of the external burst signal, plus the internal subcarrier signal. Under normal operating conditions, the output of Q5331 is an alternating positive and negative dc voltage level during burst time; the output of Q5411 is a negative dc voltage level during burst time. The output of each demodulator filter drives the AC Pulse Amplifiers.

Q5451-Q5457 and Q5441-Q5447 amplify the demodulated chrominance signal level obtained from the filters and drive memory capacitors C5545 and C5458.

Back Porch Clamps. Q5551 and Q5467 hold the inputs to the Quad Phase Burst Rectifiers and Buffer Amplifiers at 0 volts during non-demodulation time. This allows the memory capacitors to charge to a dc level dependent upon the phase and amplitude of the demodulated signal.

During back porch time, a signal applied from the Back Porch Gate Generator turns Q5467 and Q5551 off. This permits the charge on the memory capacitors to drive the Burst Rectifiers and Burst Clamp stages.

Burst Rectifiers. Q5461 and Q5651 are the active components of this stage, and are connected as phase inverters. This allows detection of the demodulated signal in any quadrant.

During back porch time, any charge on memory capacitors C5458 and C5545 drives Q5461 or Q5651 to produce a positive or negative (depending on phase) output. The more negative pulse is then coupled through one of the diodes CR5572, CR5576, CR5660, or CR5651 to drive the PAL Switcher stage.

Burst Lock Disable

Q5487 is the active component of this stage and is used to turn on the Burst Clamps except during Gen-Lock.

With the 148-M operated in the non-Gen Lock mode (no incoming sync), Q5487 is turned on by a signal from the Sync Present Detector (see Diagram 9). This turns the clamp transistors on, clamping the output of the Quad Demodulator stage at all times.

Burst Clamps

The V Burst Clamp and the U Burst Clamp stages are identical; only the V Burst Clamp will be explained.

Q5561, an emitter follower, passes the signal to clamp transistors Q5581 and Q5591. The clamp transistors are driven alternately from the PAL Switcher stage, hence the drive to Q5891, an emitter follower, is clamped in one direction and the drive to Q5591 is clamped in the opposite direction. The drive to Q5991, an emitter follower, is therefore an average of these two clamps.

PAL Switcher

Q5581 provides current, depending upon burst phase, to Q5597 and Q5691, a current switch. It is used to provide alternate switching to the clamp circuits.

PAL Preset

Q5997, an inverting amplifier, is used to control the Bruch Sequence (see discussion of Diagram 8).

DIAGRAM 5c

Subcarrier Oscillator and Frequency Control

The Subcarrier Oscillator and Frequency Control circuitry is used to switch the internal 3.58 MHz oscillator from a free run mode to a locked mode or vice-versa.

500 Hz Filter. R5784-C5680 and R5684-C5788 filter the signal pulses from the Quad Demodulators to provide a signal that corresponds to the amplitude and phase of the external burst.

Quad Phase Rectifier. To provide lockup independent of external burst phase errors versus internal subcarrier phase at the moment of Gen-Lock attempt, Q5871-Q5877 and Q5881-Q5887 are connected as paraphase amplifiers. The output of each amplifier is applied to a peak detector.

Peak Detector. The peak detector circuit consists of CR5874, CR5984, and CR5985. The most negative dc level from the Quad Phase Rectifier circuit is detected and applied to the DC Buffer Amplifier.

DC Buffer Amplifier. Emitter-follower Q5981 acts as a buffer and provides the necessary drive for the AGC Comparator and Burst Present Detector circuits. The output of the buffer is filtered by R5774 and C5866 to ensure an average dc level control voltage to the above circuits. The filter has an approximate bandpass of 5 Hz, which causes noise that appears at this point to be common mode to both sides of comparator Q5781-Q5671.

AGC Comparator. Q5781 and Q5671 are connected as a differential comparator with the base of Q5671 referenced to a fixed DC level. The AGC comparator is biased by the output level of Q5981 so that Q5671 is switched off, thus no AGC current is available to the AGC amplifier. With Gen-Lock, the output from the peak detector drives the AGC comparator so that an AGC current, corresponding to the amplitude of the externally applied burst signal, is developed through Q5671. This current is fed back to the Chroma AGC Amplifier and increases or decreases the overall chroma gain. Under normal Gen-Lock operation, burst amplitudes of approximately 71 mV to approximately 286 mV switch the comparator and produce an AGC output current.

Burst Present Detector. Q5987 and Q5971 are connected as a Schmitt Trigger circuit. If external burst is present, the output dc level from the buffer (Q5981) steps down and triggers the Schmitt circuit. The differential output of the Schmitt circuit drives the subcarrier reference switch.

Subcarrier Reference Switch. Q5921 and Q5941 form this circuit, which is controlled by the Burst Present Detector. When not Gen-Locked, both transistors are saturated. This provides a resistive divider consisting of R5910, R5920 (3.58 MHz adj.), and R5912 connected between −15 volts and ground (through both transistors). Control of the 148-M internal oscillator frequency depends on the setting of R5920. When Q5921 and Q5941

are reverse-biased by the output of the Burst Present Detector, the Subcarrier Reference Switch circuit "floats". Control of the internal master oscillator now depends on the Quad Demodulators output signals that are applied to Error Amplifier Q5937-Q5951.

Error Amplifier and Band Switch. This circuit controls the 148-M oscillator frequency during Gen-Lock mode of operation. Q5937 and Q5951 are connected as an integrating operational amplifier with C5956 as the feedback capacitor. Ri for this amplifier consists of R5762 or R5762 shunted by R5863 and transistor switch Q5861.

The rate of integration of the operational amplifier is changed by switching Band Switch transistor Q5861 on or off. The input resistance (Ri)is low when Q5861 is switched on. This increases the rate and amount that the amplifier output voltage shifts the internal master oscillator. With Q5861 turned off, the rate is relatively slow (Ri high) and the bandwidth shift of the oscillator is narrow, improving the noise immunity of the amplifier. Control of Q5861 is obtained from the Quad Lock Detector circuit.

Quad Lock Detector. The Quad Lock Detector circuit consists of a lock delay circuit (Q5961) and a Schmitt multivibrator circuit (Q5851-Q5857). The output of the multivibrator controls the Band Switch.

During initial Gen-Lock, Q5961 is forward-biased by a negative pulse applied via CR5952 from the Burst Present Detector circuit. This discharges C5950, which turns Q5857 on. The output of the detector (collector circuit of Q5851) is therefore a negative gate that switches Q5861 on. When lock occurs, Q5961 is turned off by the quadrature signal from the Demodulator circuit, allowing C5950 to charge towards +15 volts. This delays triggering the Schmitt multivibrator to turn Q5861 off, which ensures lock has occurred.

Q5931 is part of the Reed Switch Drive Circuit as described with Diagram 9.

3.58 MHz Oscillator

The 3.58 MHz crystal controlled oscillator generates the subcarrier used by the 148-M. In the free-running mode, the frequency will be within 25 Hz of 3.57561149 MHz. In the locked mode, the frequency will be locked to the incoming program burst. The output is amplitude limited and applied to the Subcarrier Output Amplifier (see discussion of Diagram 9) for further processing.

DIAGRAMS ⑥a and ⑥b

The Function Generator generates the field sweep signal and the sinusoidal burst packets of the multiburst signal. The average level and the white reference level of the multiburst signal, the center level of the field sweep signal, and the noise pedestal are also generated on this circuit board.

M. B. Enable

When a multiburst signal is to be generated, Q6103 receives a high state signal from the logic control circuitry on Diagram 4. This causes all of the diodes driven by the cathode of CR6017 to become reverse-biased. This now allows any of the transistors in the column headed by Q6106 to conduct, providing the remaining diode in the emitter circuit is also reverse-biased.

Multivibrator Rate Control

This stage sets the rate of charge and discharge current for the integrator within the Triangle Generator circuit.

The emitter circuits of Q6266 and Q6164 are such that, for any given base voltage, Q6164 demands twice the current as Q6266. This base level is set by emitter follower Q6262. Q6106, Q6212, Q6222, Q6228, Q6233, Q6244, and Q6149 set the current through R6144. Each sets a specific base voltage for Q6266 and Q6164.

Refer to Q6106. When the anode of CR6013 is low, enabling multiburst, and CR6113 receives a low from Diagram 2_a, R6117 and R6304 set the current through Q6106 and R6144. The resulting voltage drop across R6144 sets the base voltage on Q6262.

Q6149 works like the other rate control transistors, except the input to the emitter is a complex signal made up of the control and marker logic developed by the circuits on Diagram 4, and the ramp generated on Diagram 10.

Current Switch

This stage provides charging and discharging current for the integrator within the triangle generator. The Current Switch circuit is controlled by the Triangle Level Detector.

Current demanded by Q6266 is provided by U6170B. U6170A and U6170C form a constant current generator providing the same current flow as in U6170B.

Q6162-Q6068 is a current switch providing current for Q6164. When Q6068 is conducting, pin 1 of U6170 drives the Triangle Generator. When Q6068 is cut off, Q6162 turns on, connecting Q6164 to U6170 pin 1. Because Q6164 requires twice the current available from U6170A and C, an equal amount of current is drawn from the Triangle Generator.

Triangle Generator

This stage is basically an integrator, providing linear positive and negative ramps. The charging and discharging currents driving the integrator determine the ramp rate.

The triangle generator consists of Q6398 and Q6494-Q6482. The latter transistor is normally held in a clamped or conducting condition when no signal is desired from the triangle generator. When it is desired to generate a triangular signal, CR6376 is reverse-biased and Q6482 is cut off. At this time, the frequency determining current described above is allowed to flow in integrating amplifier Q6398-Q6494. The remaining transistors in this section of the circuit form an emitter follower; the voltage at the emitter of Q6593 is essentially the same as that on the collector of Q6494.

When current flows from the Current Switch to the integrator, the base of Q6398 moves negative. The emitter follows, driving the base of Q6494 down negative. Inversion and amplification take place within Q6494. Negative feedback for a linear positive ramp is provided by C6382.

At +5 V ramp amplitude, the Triangle Level Detector switches the Current Switch. When current is drawn from the integrator, the base of Q6398 moves and a negative ramp is generated. The direction of input current will again be switched at −5 V ramp amplitude.

Ramp rate is determined by the magnitude of input current. As current in both directions is of the same magnitude, the ramp rates (positive and negative) are the same, resulting in symmetrical triangle waveforms of a particular frequency.

Triangle Level Detector

When the output of the Triangle Generator reaches +5 V, the voltage at the base of Q6786 turns it on, switching CR6182 to its low state. This turns off Q6068.

When the output of the Triangle Generator reaches −5 V, the voltage at the base of Q6877 reaches turn on bias, switching CR6182 to its high state. This turns on Q6068.

Stop Control

This stage controls the level at which the Triangle Generator stops; and inhibits the generator during non-multiburst time. To generate a burst packet for the multiburst signal, a positive-going pulse of the necessary width is applied the emitter of Q6198 from the Mod Pulse Timing circuit on Diagram 2. This signal in turn causes a positive-going voltage to appear across R6398, turning Q6298 on and Q6392 off. This allows CR6376 to reverse-bias; at that time the Triangle Generator starts to run. When the pulse at the emitter of Q6198 goes low and Q6198 cuts off, the voltage across R6398 does not immediately go back to its negative condition. It is held up by Q6095. Q6095 is driven from a switching pair, Q6091-Q6192, which is essentially in parallel with the switching pair that controls the current reversal in the Current Switch circuit. Q6095 will only allow the voltage across R6398 to go negative during the positive half cycle. This ensures that the burst packet will end only during the positive-going half cycle. The Stop Level circuit determines the burst packet ending point.

Stop Level

This stage sets the quiescent or 0 level of the Triangle Generator.

The voltage at the base of Q6569 is very nearly equal to the output voltage of the Triangle Generator, that is, the collector of Q6494. As the output rises during the positive-going half cycle, it eventually reaches a point where it is equal to the voltage selected by potentiometer R6673. At that point, Q6482 turns on and the Triangle Generator stops.

Diode Shaper

In this circuit 12 diodes (see Diagram 6_b) are used to shape the triangular waveform into a sinusoidal waveform. Each diode is biased at a particular voltage and is connected to the necessary series impedance to produce the desired change of slope of the triangular signal to produce a good approximation of a sinusoidal signal.

Amplifier

Q6653B, Q6758, and Q6852 form an operational amplifier that sets the amplitude of the multiburst. Q6653A and Q6858 provide temperature compensation.

R6942 matches the reference level of all Full Field Test Signals to the vertical blanking level.

R6741 (MB GAIN), in series with R6844, controls the gain of the amplifier. It is shunted by a bandpass limiting network. C6740 and R6736 (MB BANDPASS).

Multiburst Pedestal

Two transistors are used to determine the average level and the white reference level of the multiburst signal. Each of these transistors is held cut off by the high state of the M. B. Enable signal at the anodes of CR6913, CR6918, and CR6923. This signal goes to a low state whenever a multiburst is to be generated. At that time, the other diodes in the emitters of these transistors control the collector current. Q6813 determines the center or average level of the multiburst signal and is adjustable by R6833. The white reference level set by R6835 is switched on by Q6824. Q6803 sets quiescent current in the amplifier on Diagram 7. The circuitry around Q6828 is not used.

Noise Pedestal

This circuit supplies the current to set the pedestal level of the NOISE test signal. It is controlled by the front-panel NOISE and PEDESTAL switches.

The NOISE pedestal is enabled by a low input to the anode of CR6603, allowing Q6715 to conduct through CR6705. PEDESTAL current is set by S9230 and R9230 in the DELETION mode. R9225 modifies the PEDESTAL current when S9225 is in the INSERTION mode. This provides a VARIABLE PEDESTAL.

Field Sweep Pedestal

A low Field Sweep Enable turns off CR6703, allowing current from R6724 to flow through Q6803 and generate a pedestal for the FIELD RATE SWEEP GEN signal.

DIAGRAMS ⑦a and ⑦b

This board contains the two major output amplifiers for the instrument. One amplifier handles luminance signals; the other handles the chrominance, noise, and the burst packets of the multiburst signal. This board also contains the External VITS Amplifier and a clamp circuit, which ensures that the black level of inserted VITS matches that of the incoming program signal. The sine-squared pulse and bar generators, together with the sine-squared shaping filters, are also included on this board.

Pulse Generator

The T or 2T sine-squared pulse is generated by driving a sine-squared shaping filter with a very narrow pulse. When a 2T or T pulse is desired, a negative-going pulse is inverted in L7110 and applied to the base of Q7001. This turns on Q7001 and discharges C7212 through Q7221. The amplitude of this pulse is determined by the value of the voltage to which C7212 was charged prior to its discharge time. This in turn is determined by either R7138 (T pulse) or R7131 (2T pulse). The resulting pulse of current in the collector of Q7221 is applied to either the T or 2T filters.

Bar Generator

Negative-going bar width pulses allow emitter current to flow in Q7241, which is adjustable by R7143. The resulting current is applied to either the T or 2T filter. Selection of T or 2T risetimes or pulse widths for the bar and pulse is made by placing the jumpers on P7321 as described in the operating instructions. Q7531 biases Q7241 and provides thermal compensation.

Modulated Pulse Luminance Amplifier

The modulated sine-squared pulse is composed of the linear addition of a 12.5T luminance pulse and a 12.5T envelope chrominance pulse. The luminance portion of this signal is applied to pin 1 of P7193, passes through Q7630A and is delivered to the modulated pulse luminance filter.

Filters

The T and 2T sine-squared shaping filters are used to produce sine-squared transitions from the very fast Pulse or Bar Generator[1]. Several other inputs are also provided to the T and 2T filters. These include all the various pedestal signals associated with CCIR-II, noise, the FIELD RATE SWEEP GEN signal, and all the various flat field signals. The luminance portion of the staircase and full line linearity signals are also applied to the 2T filters. These various inputs appear on P7101 and pins 3 and 4 of P7001. The modulated pulse luminance filter is used to produce a delay equal in value to the delay of the modulator and its associated bandpass filter, so that both the chrominance portion of the modulated sine-squared pulse and the luminance get the same amount of delay. Thus, the resulting composite pulse exhibits no chrominance-to-luminance delay. Q7431 biases the drive transistors, Q7321 and Q7331.

Luminance Amplifier

The luminance amplifier consisting of Q7711, Q7811, Q7911, and Q7921, receives signals from the outputs of each of the three filters mentioned previously. The amplifier is an operational amplifier whose gain is set by R7735. Its output impedance is low enough to drive three 75 ohm loads. These are the front and rear full field test signal jacks and the termination provided by the External VITS Amplifier.

Chrominance Amplifier

This amplifier is very similar to the Luminance Amplifier; however, associated with its input circuitry are several auxiliary circuits. The chrominance enters this

[1]A Kastelein "A NEW SINE-SQUARED PULSE AND BAR-SHAPING NETWORK" IEEE Transactions of Broadcasting, Volume BC-16, Number 4, DEC. 1970 (pp 84-89).

amplifier at pin 2 of P7691 and may be adjusted in amplitude with R7661. The noise signal enters at pin 6 of P7691. The flow of noise is controlled by two noise gating transistors, Q7551 and Q7651. The level of the noise may be adjusted with R7561. Multiburst and Field Sweep enter at pin 1 of P7491. Signal current flows at all times through R7551 and R7553. This is sufficient to produce the 350 mV amplitude. When the amplitude is desired, Q7481 is cut off by the MULTIBURST AMPLITUDE switch on the front panel and signal current then flows through two parallel paths: R7551-R7553 and R7461-R7581. Both Q7481 and Q7571 are gated to inhibit the passage of the multiburst signal during the 9 Line Keyout pulse.

Ext VITS Amplifier

An external VIT Signal may be inserted on the program output of the 148-M. Such a test signal is applied to J9011 on the rear panel. This signal is amplified by Q7981, Q7971, and Q7961. The output of this amplifier is connected to the VIT Signal input of both the preview and program VIT Signal switches.

VITS Amp Clamp

Since the incoming program signal is clamped to ground, as described in Diagram 0, the internal VIT Signals are also clamped to ground so that, when they are inserted, the two black or ground levels match.

A sampling pulse is supplied to pin 1 of P7003 during the back porch portion of the internally generated test signals. Q7191 is turned on by this clamp pulse and the resulting sampled level is transferred to memory capacitor C7383. This voltage is amplified by high-gain operational amplifier U7291. This amplifier error signal is further amplified in the Ext VITS Amplifier and applied once again to the same point as originally sampled. This restores the back porch level of the VIT Signals to ground.

DIAGRAM 8

The circuitry on Diagram 8 is used to shape and phase signals to drive the modulator. Exceptions: Q8911 and CR8910 form a current switch that is used to set the amplitude of the regenerated composite sync for use with the full-field test signals.

Subcarrier Phase Control

For standard test signals, three discrete phases of subcarrier are needed. These are 135° and 225° for the phase alternating burst, and 180° for all test signals. A CW subcarrier signal is supplied to P8100-1. This signal is steered through one of three phase shift networks, depending upon which test signal component is desired. The two burst phases are determined by the phase shift networks in the emitters of Q8150 and Q8158. Each of these transistors is turned on during alternate horizontal blanking intervals by the four-diode and gate, which is supplied with horizontal blanking by way of P8100-3 and a pair of line alternation pulses from the Bruch Burst Blanking Circuit. The 135° test signal phase is determined by the phase shifter in the emitter of Q8158. The subcarrier signal is steered through this transistor during the active line time. The switching logic is contained in U8110C. The outputs from each of these phase shift channels are combined at the emitter of Q8261. In the collector of this transistor is a parallel resonant circuit containing a voltage-variable capacitor. The dc voltage applied to this element is governed by the INSERT SUBCARRIER PHASE control on the front panel and is required to trim the test signal phase to be properly referenced to the incoming program signal.

Subcarrier Amplifier

The Subcarrier Amplifier circuit ensures that the modulator is always driven with the same amplitude of subcarrier, and corrects for symmetry in the input signal so that the modulator is driven with a balanced waveform.

The limiter amplifier, Q8371, with diodes CR8385 and CR8384, amplifies and limits the peak-to-peak subcarrier amplitude to about 1.2 volts.

The limited (squared) subcarrier signal at the collector of Q8371 is coupled through R8378 and C8574 to a paraphase amplifier (Q8471 and Q8571), which drives the push-pull output stage (Q8579 and Q8679). C8472-R8552 and C8654-R8554 integrate the signal, changing the squared wave to a trapezoidal waveform. This signal is ac coupled through C8558 and C8652 to the bases of Q8579 and Q8679, providing a drive signal with a 50% duty factor.

The amplitude of the triangular signal at the bases of Q8579 and Q8679 drives them into saturation and cutoff, producing a subcarrier-rate square-wave signal across the primary windings of L8660.

Bruch Burst Blanking

The Bruch Burst Blanking circuitry generates an eleven-line wide meandering pulse, which ensures that the first and last bursts of each field will be of the same polarity according to Fig. 3-4. This improves the stability of color synchronization.

U8620A is triggered by VITS H Blanking, and receives a PAL Preset pulse at the Clear input. The output of U8620A is a PAL square-wave; which also controls the PAL Switcher on the Gen-Lock circuit board, and 135° and 225° phase circuits in the Subcarrier Phase Control

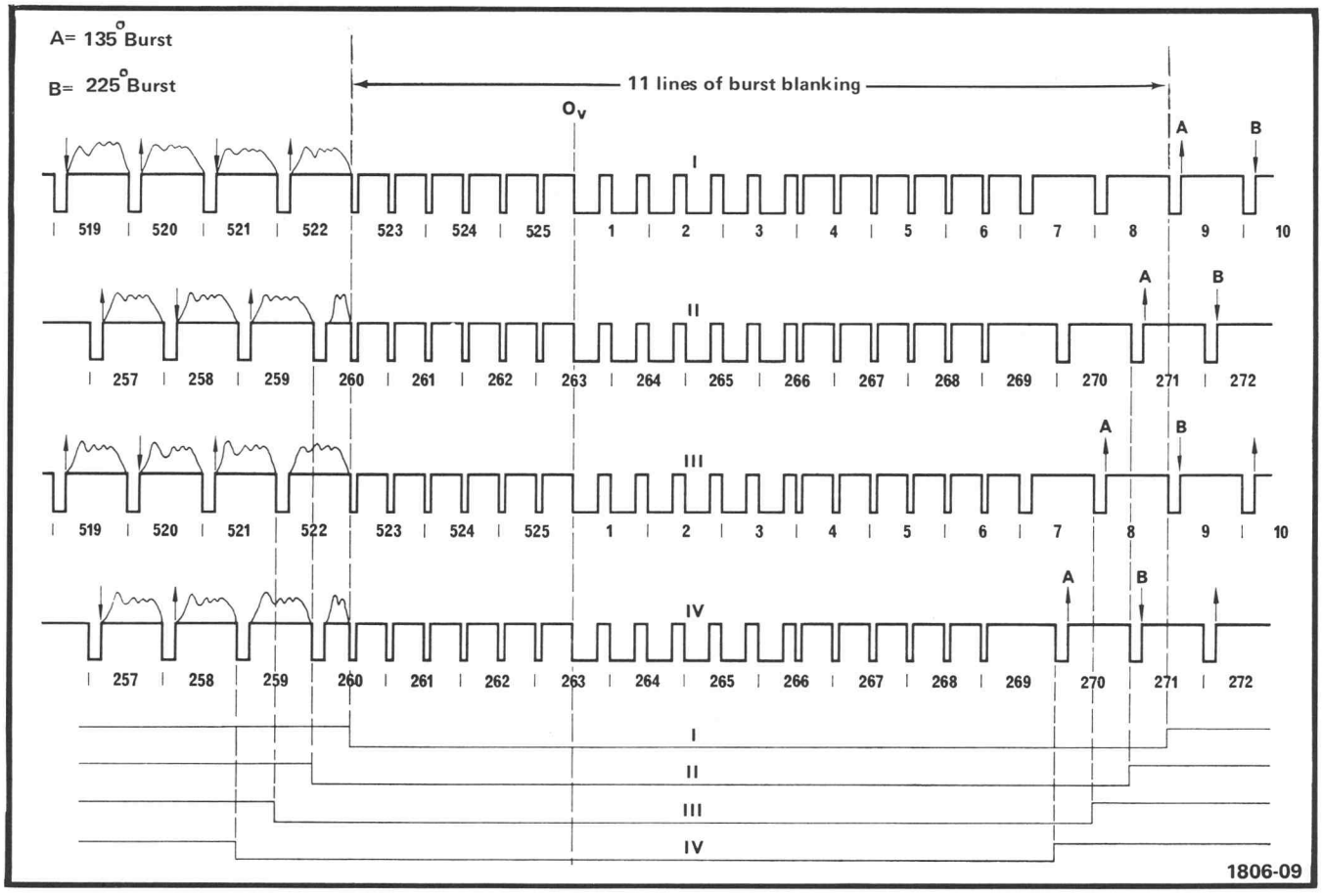


Fig. 3-4. PAL-M burst blanking sequence and field blanking interval. From *CCIR Conclusions of the Interim Meeting of Study Group 11.* **Geneva, 1972 Part I, Recommendation 470 (Rev. '72), page 41.**

section of the modulator. The complementary PAL square-waves drive the clock pulse inputs of U8720A and B. The Bruch Start signal is inverted by U8820A, then drives the D (data) input of U8720B and the Set input of U8720A. The Bruch Stop signal goes to the Set input of U8720B. The outputs of U8720A and B (field rate pulses with varying widths) are fed to the Set and Reset inputs of U8820B and C. The output of U8820B and C is the eleven-line wide "meandering" gate. This switches CR8536 on, turns Q8641 off, and shuts burst off during gate time.

CCIR-I and CCIR-II Chroma

These two stages consist of 5 current switches, which are used to set the amplitude of the chroma on the CCIR-I and CCIR-II signals for use in the modulator.

Each transistor is a current source whose current is set by the emitter resistance. The transistor conducts when both disconnect diodes in the emitter circuit receive low enabling signals. When either diode is high it shunts current away from the transistor. Q8281 controls CCIR-I chroma. Q8171, Q8172, and Q8279 control the CCIR-II chroma.

Modulator Drive

This stage provides the current required for modulation of the 3.57 MHz subcarrier for burst, modulated sine-squared pulse, modulated sine-squared bar, staircase, CCIR-I, CCIR-II, and SIG-III test signals.

The burst envelope filter consists of L8730 and associated capacitors. Current is steered through Q8641 to make a burst at such times as two conditions are present. One is the burst flag itself and the other is an enabling signal from the Bruch Burst Blanking Circuit. Burst amplitude is set by R8431. Current to produce the chrominance portion of all other test signals flows through the slower filter consisting of L8381 and associated capacitors. The modulated 12.5T pulse appears at P8960-2. A dc-balancing signal derived from the 12.5T sine-squared generation circuit appears at P8960-4. These last two signals are applied to the push-pull input of the modulator drive circuit, which is the base of Q8851A and B. The 12.5T chroma level is set by R8870.

Modulator

The modulator consists of double-balanced modulator U8890. The modulator has two pairs of terminals, one for

the subcarrier or switching signal (pins 7 and 8 of U8890) and the other pair for the modulating signal (pins 1 and 4). Two balance adjustments, R8990 and C8997, ensure that there is no subcarrier output when there is no signal input at the modulating terminals of the modulator.

Bandpass Filter

This stage consists of a pair of series resonant tanks, consisting of L8590, C8498, L8580, and C8488, tuned to 3.57561149 MHz. The placement of these tanks (one in each output lead) ensures symmetrical output; the component values limit sideband output.

Full Field Sync

Q8911 and CR8910 form a current switch for the composite sync current developed in R8938 and R8920. Comp sync from Diagram 9_a switches CR8910, allowing current to flow through Q8911 to the filter circuit on Diagram 7_a. U8820D and CR8924 are not used.

DIAGRAMS 9a and 9b

The circuitry contained on the Subcarrier and Sync board is used to provide current for the burst and composite sync amplifiers for use at the CW SUBCARRIER OUTPUT and COMP SYNC OUTPUT. In addition, sync lock detection, generation of the modulated sine-squared pulse, and the FULL FIELD SIG mode sequence are included.

Comp Sync Amplifier

CR8 and Q21 form a current switch. When CR8 is reverse biased, current through R7 is diverted through Q21, which drives the filter (L20, L120, C32, C28, and C46). The filter limits the risetime of the composite sync signal.

Q71, Q141, and Q151 are the active components of an operational amplifier. R42 is the feedback resistance; the input current is determined by R7. Q61 provides current for reverse-terminating any negative pulses that may appear at the output terminal due to unterminated coaxial cables.

Q381 provides drive to the VITS switch control (see Diagram 0_b) so that, in the event of PROGRAM INPUT interruption, internally generated Full Field signals will be switched to the PROGRAM LINE OUTPUT.

Subcarrier Amplifier

Emitter-follower Q81 serves as a buffer and driver. It isolates the oscillator (see Diagram 5_c) from the output. Because Q81 is biased near cutoff, it clips the negative portion of the input signal so that the drive signal to Q91 pulses the collector tank circuit (L190, C196, C194, and C198).

The output from the tank drives an operational amplifier consisting of Q181 and Q271. This circuit serves as a distribution amplifier to drive the various circuits within the 148-M, plus the CW SUBCARRIER OUT connector. Q171 sets the level at the emitter of Q181, and provides thermal compensation.

A relay, K370, opens the CW Subcarrier output line in the event burst is lost from the driving source. (See Operating Instructions for exception.)

Vert Sync, Horiz Sync, and Regen Sync Timing

These three sections of Diagram 9 are best treated as one. Regenerated sync should be contrasted with separated sync. The latter is stripped from the incoming program signal and therefore contains the identical timing information of that signal, including any jitter if present. The timing for regenerated sync is derived from the internal timing circuits of the 148-M, and is present even in the absence of an incoming signal.

The train of pulses that form the regenerated sync signal are formed in monostable multivibrator U301. There are basically two inputs to this multivibrator: One is a trigger or timing input, which determines the leading edge time location of each of its output pulses (Horiz Sync). The other input determines the width of the pulse (Vert Sync).

The standard composite sync signal requires that the trigger pulses appear at a line repetition rate during most of the active field, including most of the vertical blanking interval. However, during the 9 line interval that includes the equalizing pulses and the vertical sync pulse, the timing information rate must be doubled to twice line rate. Similarly, the width of the regenerated sync pulses must be of line sync width during the active portion of the field, including most of the vertical blanking interval, but must be appropriately narrowed for the equalizer pulses and widened to produce the serrated vertical pulse.

The pulse width of monostable multivibrator U301 is determined by three current paths into the pulse width timing capacitor C337. R356 and R336 provide current at all times and represent the minimum amount required for the production of the serrated vertical pulses. A second path, controlled by Q321, supplies additional current when normal line rate sync pulses are required. This transistor is driven by a 9 Line Keyout pulse, which stops flow of current during the 9 line interval around the vertical sync pulse.

The third current path is supplied with a complex signal that steers the largest amount of current into the monostable multivibrator during the first and last 8 lines of the vertical sync interval. During the middle 8 lines of this interval, the current is interrupted, leaving only the steady minimum value to produce the serrated pulses.

The logic to produce that control signal comes from the Vert Sync circuit. Two characteristic instant pulses drive U321A, producing a twice-line rate timing signal. This timing signal is applied to the trigger input of counter U201. This counter is connected to count by 6, producing an output after the sixth timing pulse at its input. The output pulse lasts for a period of six more twice-line rate pulses, and is combined by U101C with the 9 Line Keyout pulse to produce first a high, then a low, then a high state corresponding to each third of the 9 line interval. This output occurs only once per field (since the 9 line signal itself is used to reset the counter during active field time), and is inverted and applied to the base of Q331 to control the necessary current to produce equalizer and serrated pulses.

The timing pulses to trigger the monostable multivibrator are formed in the section of the diagram headed Horiz Sync. Again, the 9 Line Keyout pulse is required, since the timing during this interval is twice-line rate and outside this interval, at the line rate. U321D acts as an OR gate receiving a characteristic instant on pin 13, which produces line rate triggers. During the 9 Line Keyout interval, U321C permits the passage of a second characteristic instant into pin 12 of U321D. The output on pin 11 then contains twice-line rate triggers during the 9 line interval. Timing control and width control has therefore produced a standard train of composite sync pulses at the output of the monostable multivibrator on pin 6 of U301.

Burst Key

This circuit forms the burst flag pulse. The trailing edge of the horizontal sync pulse drives the base of Q421 negative to −5 V, cutting off Q421. Q421 remains cut off for approximately 1 μs while C415 charges back to 0.6 V. When Q421 turns on, a negative 5 V pulse is passed by Q406 to the base of Q428. Q428 cuts off for approximately 2.5 μs while C407 charges back to +0.6 V. The resulting positive pulse is inverted by Q408 and becomes a low enable to Diagram 8, delayed 1 μs from horizontal sync. In the event burst is lost from the driving source, R408 receives a low inhibit from Diagram 5_c and no burst key is generated.

Non Sync Inhibit

This stage compares incoming Stripped Sync with Regenerated Sync and inhibits the Line Counter and VITS Key circuits (see Diagram 4) if they are not in step.

The output of U101B is high when both inputs are low, and low when either input is high. Because Stripped Sync on pin 5 and Regenerated Sync on pin 6 are of opposite polarity, one input will be high at all times when they are in step. The resulting low output cuts off Q351. C374 charges positive, turning on Q391 which turns off Q394.

Should incoming sync and Regenerated Sync be out of step (or one not present), U101B senses coincident low states on pins 5 and 6. The resulting output turns Q351 on, discharging C374. Since charge time for C374 through R362 is considerably longer than discharge time through Q351, the bias to Q391 is held below conduction. The collector of Q391 is high, turning on Q394, generating a LOW FOR NON SYNC signal.

Due to the impedances of these charge and discharge paths, a full field is required to charge C374, and about 12 unsynchronized lines to discharge C374.

SIN^2 Pulse and Bar Generator

This stage is used to generate the luminance portion of the modulated sine-squared pulse and bar.

For the CCIR-I and SIG-III signals, Q498 (see Diagram 9_b) is turned on by a positive pulse from Diagram 2_b. The collector of Q498 goes negative, discharging C487 through Q466 into a 9-pole Kastelein filter. This pulse of current is shaped into the luminance pulse and is sent to the circuits shown on Diagrams 7_b and 8.

For the MOD PULSE & BAR signal, Q498 is turned on by a pulse from Diagram 10. The modulated bar is formed by Q499, CR498, and CR498, with timing information from Diagrams 2_a and 4. The timing pulses switch current from R499 and R482 through Q499 and into the filter.

Flat Field Logic

A high FLAT FIELD ENABLE is generated at U470B pin 8 when pins 9 and 10, and pins 1 or 13 are low. Two high inputs on pins 1 and 2 are required for a low output on pin 3 of U450A. The operation of U470A is the same as U470B. Q449 acts as an inverter to drive U470A pin 2 and provides an output that is complementary to that of U359A.

Alternate Switching Logic

This circuit provides complementary ALT switching signals to the Full Field Logic circuit on Diagram 4.

The output on pin 3 of U359A is low each time pin 8 of divide-by-2 counter U339B is high and pin 1 of U359A is high. Pin 1 of U359A is grounded by S9280 only in the ALL LINES position of the front panel switch.

FULL FIELD ENABLE is high on pin 8 of U359C when either input is low. Pin 9 is driven by U359B for ALL LINES and ALT modes. When U359B pin 4 is high and the MODIFIED VERT BLANKING on pin 5 is high, the output pin 6 is low. Pin 10 of U359C is driven by U359D for FULL FIELD SIG & 3 LINES FLAT FIELD. U339B is clocked 2 μs after the start of each line and divides by 2 so that pin 9 of U339C is high for one line and low for the next. U430A divides by 2 again, providing an output with alternating polarity every two lines. U359D combines the outputs of U430A and U339B so that the output on pin 11 is low for one line then high for three. All counters are reset by MODIFIED VERT BLANKING and held off for the vertical blanking interval. U450B enables U470B for the 3 lines of flat field.

When the jumper on P430 is moved to pins 1 and 2, ALT & 6 LINES FLAT FIELD is enabled. The input to pin 12 of U359D is changed from the output of U339B to the output of U430B. This adds another divide-by-2 to the circuit, giving an output at pin 11 of U359D of two lines low, then six lines high.

LOW FOR WINDOW appears at pin 1 of P461 when CR456, CR454, and CR452 are all low. U450D inverts FULL FIELD ENABLE.

VERT BLANKING is modified to start and end coincident with the end of a line in all fields by U339A. Pin 5 steps low with pin 1, but does not step high with pin 2 until pin 3 is triggered by the characteristic instant pulse for TIME 31 from Diagram 2_a.

MOD PULSE ENABLE

This is part of the circuitry for MOD PULSE ENABLE on Diagram 2_b. U450C pin 8 is low when pins 9 and 10 are high.

DIAGRAM 10

There are two circuit boards shown on Diagram 10, the Ext Drive and the Field Sweep boards.

Field Sweep Ramp Generator

U9678, C9676, and R9674 form an integrating operational amplifier. Q9670, switched on by the modified vertical blanking signal from Diagram 4, discharges C9676 during the vertical interval. When Q9670 turns off, current flows through R9674. Operational amplifier U9678, keeping its inverting input at 0 volt, supplies voltage at its output so that the current will flow through the capacitor. This produces a negative-going ramp, about 12 volts in amplitude. The amplitude of the ramp is changed by R9672 and R9623 before going to the function generator. Adjusting the amplitude allows positioning of the center frequency.

Field Sweep Logic

When FIELD RATE SWEEP GEN signal is selected, U9601C pins 9 and 10 are grounded, putting a high on the Preset of U9694A. This enables U9694A. The flip-flop receives an H Blanking clock pulse and field marker timing at the data input. This provides field markers at the output on pin 5. These markers are each two lines wide.

U9601D pin 12 receives a high from the control logic on Diagram 4. Pin 13 gets horizontal timing information (FLD SWP LINE ENABLE) from Diagram 2_a. The output goes to the function generator enable circuit on Diagram 2_b.

MOD PULSE & BAR Logic

U9601A pin 2 gets a high from the control logic on Diagram 4 when the MOD PULSE & BAR signal is selected. Pin 1 gets horizontal timing information from Diagram 2_b. U9601B inverts the resulting pulse and sends it to Diagram 9_b to enable the MOD PULSE & BAR modulated pulse.

External Drive Receiver

This stage is used to combine externally applied Composite Sync, CW Subcarrier, PAL Pulse, and Burst Flag so that the 148-M will Gen-Lock without a PROGRAM INPUT signal.

Subcarrier. External CW Subcarrier is applied to amplifiers Q9716 and Q9714 90° out of phase, as set by C9719 (225° Phase) and L9710 (135° Phase). This provides subcarrier at 135° and 225°.

PAL Pulse. Q9735 and Q9745, driven by an external PAL Pulse, clamps the output of the 3.57 MHz 135° and 225° subcarrier at 0 volt except during burst time every other 64 μs (i.e., burst is at 135° on one line, then 225° on the next).

Burst Flag. Q9778 and Q9776, driven by external Burst Flag, clamps the 135° burst and 225° burst at 0 volt except during the time of burst.

Comp Sync. Composite sync is summed (at the junction of C9799 and R9796) with burst to provide the signal required for 148-M Gen-Lock.

DIAGRAM 11

The Low Voltage Power Supply circuit provides three regulated supplies; +15 volts, +5 volts, and −15 volts. Electronic regulation is used to provide stable, low ripple

output voltages. All the supplies are current-limited to prevent instrument damage in the event that a supply is shorted to ground. The primary circuit of the transformer employs voltage and range selector plugs to permit selection of the appropriate line voltage operating range.

Power Input

Power is applied to the primary winding of transformer T9001 via RFI Filter FL9201, the POWER switch S9201, 115-volt line fuse F9201, Voltage Selector S9203, and the Range Selector S9202. The voltage selector plug connects the split primaries of T9001 in parallel for the 115-volt range of operation, or in series for 230-volt operation. A second fuse, F9202, is placed in the 230-volt position to provide the correct protection for 230-volt operation.

The Range Selector plug allows the instrument to regulate properly on high or lower than normal line voltages. Each half of the primary has taps above and below the 115-volt (230) point. As the selector is moved from LO, M, HI, more turns are added to the primary winding. Therefore, whether the primary voltage has increased or decreased, the secondary voltage can be maintained at a nearly constant level.

The RFI Filter serves to prevent external RF interference from appearing across T9001 and also prevents signals generated within the 148-M from being introduced into the AC line.

−15 V Supply

The −15 volt supply provides the reference voltage for the +5 and +15 volt supplies. The reference for the −15 volt supply is a 9.1 volt zener diode, VR9850.

The output from the secondary winding (pins 6 and 7 of P9850) is rectified by a bridge rectifier consisting of CR9870, CR9876, CR9874, and CR9872. The rectified voltage is filtered by C9061 and applied through a −15 volt series regulator stage, Q9085, to the load. Series regulator Q9085 and its driver, Q9850, are controlled by a voltage comparator consisting of Q9856 and Q9854 with associated components. C9852 filters any noise generated by −15 volt reference VR9850.

Q9852 and associated components, is an overload protection circuit. During excessive load current, Q9852 (normally off) turns on and limits the current from the −15 V supply.

+5 and +15 Volt Supplies

Both supplies are similar to the −15 volt supply, except that the +5 V supply uses a full wave rectifier instead of a bridge.

MAINTENANCE AND CALIBRATION

This section of the manual contains information for use in maintenance and calibration of the 148-M as follows:

Maintenance

Preventive Maintenance: Cleaning, lubrication, visual inspection, etc.

Troubleshooting: Aids for isolating trouble to a particular stage, etc.

Corrective Maintenance: Replacement procedures and parts ordering information.

Calibration

Inspection: A list of specifications to be checked when performing an incoming inspection.

Procedure: Step-by-step instructions for returning the 148-M to specification.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection and lubrication. Preventive maintenance performed on a regular basis may prevent instrument breakdown, and will sustain the reliability of this instrument.

Cleaning

General. The 148-M should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket that prevents efficient heat dissipation. It also provides an electrical conduction path.

CAUTION

Avoid the use of chemical cleaning agents that might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone, or similar solvents.

Exterior. Loose dirt accumulated on the outside of the 148-M can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt that remains can be removed with a soft cloth dampened in a solution of water and mild detergent. Abrasive cleaners should not be used.

Interior. Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low velocity air. Remove any dirt that remains with a shoft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

Lubrication

The reliability of switches and other moving parts can be maintained if they are kept properly lubricated. Use a cleaning-type lubricant (e.g., TEKTRONIX Part No. 006-0172-00) for switch contacts. This lubricant does not affect the electrical characteristics of the switch. To lubricate the switch detent, use a heavier lubricant (e.g., TEKTRONIX Part No. 006-0219-00). Do not over-lubricate.

Visual Inspection

The 148-M should be inspected occasionally for such defects as broken connections, loose or disconnected pin connectors, improperly seated solid-state devices, damaged circuit boards and heat-damaged components.

The correct procedure for most defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

Transistor and Integrated Circuit Checks

Periodic checks of the transistors and integrated circuits (IC's) used in the 148-M are not recommended. The

best indication of performance is the actual operation of the component in the circuit. Performance of the circuit is thoroughly checked when performing either the performance check or calibration procedure. Any substandard transistors or integrated circuits will usually be detected at that time.

TROUBLESHOOTING

The following information is provided to facilitate troubleshooting of the 148-M. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles.

Troubleshooting Aids

Diagrams. Circuit diagrams are provided on foldout pages at the rear of this manual. Each component, its electrical value and circuit number are shown on the diagrams. In addition, typical voltages that can be expected are also shown.

Each diagram has been assigned a diagram number and name. For example, the first diagram has been assigned the number 0_a and is called PROGRAM LINE AMPLIFIER. (Other circuitry exists on this diagram but, since the program line amplifier is of prime importance, it was so called.) Notice the tinted blue lines that surround most of the circuitry on this diagram. These lines are used to identify a particular circuit board on which the components are physically located. This reference allows for correlation between the diagrams, circuit boards, and electrical parts list. Components on the circuit board that are not shown on diagram 0_a will be found on diagram 0_b.

Table 4-1 lists the various reference diagrams, circuit boards, and electrical numbers used in the 148-M. All components located outside the blue line are chassis mounted components and have circuit numbers from 9000 to 9499.

Circuit Boards. Fig. 4-1 shows the location of each circuit board within the instrument. Each circuit board is shown (full view) opposite the appropriate diagram in the Diagram section. Each electrical component on the board is identified by its circuit number. In most cases, these circuit numbers were assigned on a grid system as a convenience to the user of the instrument. For example, notice the circuit board photo opposite diagram 0_a. The upper left hand corner of this board has been assigned numbers around 500. Proceeding left to right, the numbers go towards 900 at the upper right hand corner. From top to bottom, the numbers increase to 590 at the bottom left corner and 991 at the bottom right corner. Using this method, the physical location of each component is readily available.

TABLE 4-1

Diagram	Function or Circuit Board Name	Circuit Numbers
$9_{a/b}$	Subc & Sync Out	0-499
$0_{a/b}$	VITS Insertion	500-999
1	Vert Counter	1000-1999
$2_{a/b}$	Horiz Timing	2000-2999
$3_{a/b}$	APL-Staircase-Noise	3000-3999
4	VITS & FF	4000-4999
$5_{a/b/c}$	Gen-Lock	5000-5999
$6_{a/b}$	Function Gen	6000-6999
$7_{a/b}$	Output Amplifier	7000-7999
8	Modulator	8000-8999
12	Switching & Chassis	9000-9499
10	Field Swp & Ext Drive	9500-9799
11	Power Supply	9800-9999

Waveforms. Important waveforms (typical) are given opposite the appropriate diagram in the Diagram section. These waveforms aid in determining if a circuit is functioning properly.

Wire Color Codes. All insulated wires in the 148-M are color coded to facilitate circuit tracing. Table 4-2 summarizes the coding system used in the 148-M.

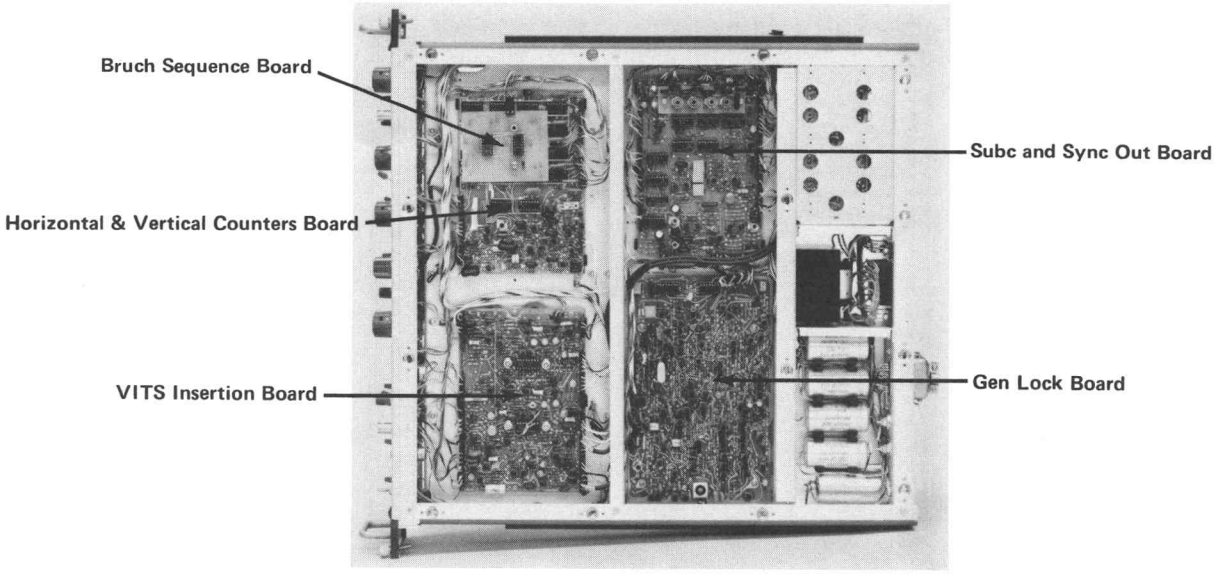
TABLE 4-2

Color Code	Significance
Black	Chassis Ground
White on Black	Floating Ground
Yellow on Green	Safety Ground
Gray[1]	AC Line
White[1]	Signal
Red[2]	$+V_{cc}$
Violet[2]	$-V_{cc}$

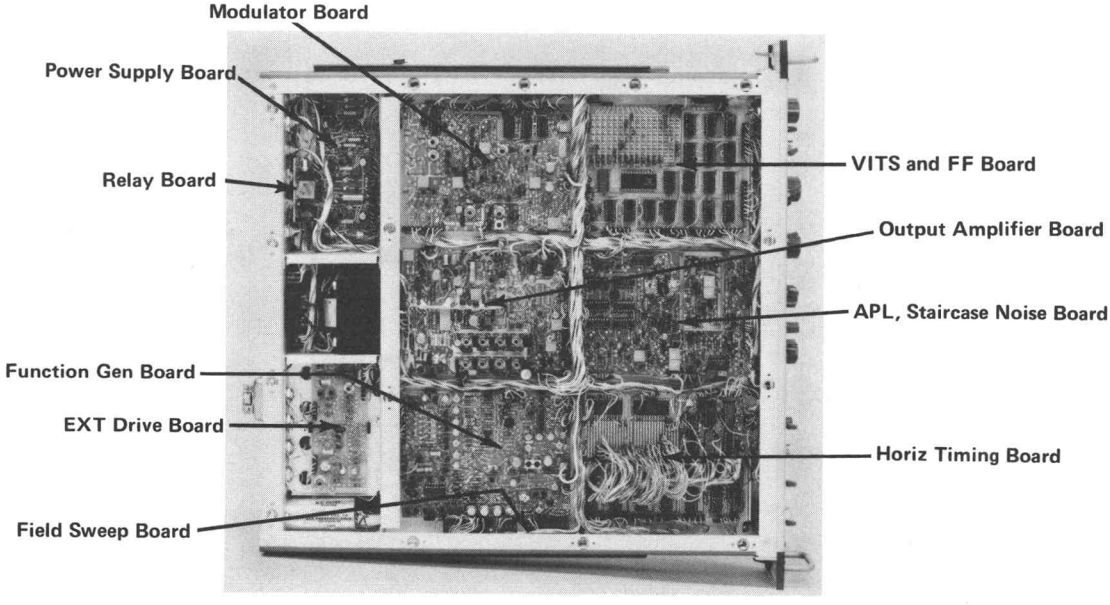
[1]Color Stripes are used on these wires as an aid to circuit tracing.

[2]Color Stripe on wire indicates position of supply with respect to 0 volt (e.g., a black stripe on a red wire would be the first voltage in the positive direction). If a second stripe is used (white only), this indicates a non-regulated supply.

Resistor Color Code. In addition to the brown composition resistors, metal film resistors (identified by their gray or light blue color) are used in the 148-M. The resistance values of composition and metal film resistors are color-coded on the components with the standard EIA color code.



BOTTOM VIEW



TOP VIEW

Fig. 4-1. Location of circuit boards in the 148-M.

Capacitor Markings. The The capacitance value of a common disc capacitor or small electrolytic is marked in microfarads on the side of the component body. The white ceramic capacitors used in the 148-M are color-coded in picofarads using a modified EIA code. "Tear drop" capacitors are color-coded in microfarads using a modified EIA code, with the dot indicating both temperature and the positive (+) side.

Troubleshooting Techniques

This troubleshooting procedure is arranged in an order that checks the simple possibilities before proceeding with extensive troubleshooting.

1. Check Control Settings. Incorrect control settings may indicate trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions.

2. Check Operation of Associated Equipment. Many times malfunction of equipment can be traced to associated equipment.

3. Visual Check. Visually inspect the portion of the instrument in which the trouble is located. Look for unsoldered connections, loose pin connectors, broken wires, damaged circuit boards, damaged components, etc.

4. Check Circuit or Instrument Calibration. The apparent trouble may only be a result of misadjustment and may be corrected by calibration. Complete calibration instructions are given in this section.

5. Isolate Trouble to a Circuit. To isolate trouble to a circuit, note the trouble symptoms. The symptoms often identify the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. A defective component elsewhere in the circuit can also appear as a power supply trouble, and affect the operation of other circuits.

The Circuit Description section of this manual can be used as a guide for isolating a trouble. This description explains how the various signal components are combined to form the video signal. By using the front-panel controls and checking the signals at the BNC connectors, it is possible to determine circuits that are functioning properly and those that are not.

When a trouble is isolated to the smallest possible area, proceed with steps 6 through 8 in this troubleshooting procedure to locate the defective component(s).

6. Check Circuit Board Interconnections. After the trouble has been isolated to a particular area or circuit, check the pin connectors on the circuit board for correct connection.

The pin connectors used in this instrument also provide a convenient means of circuit isolation. For example, a short in a power supply can be isolated by disconnecting the power distribution pin connectors at the Power Supply board when making resistance to ground checks.

7. Check Voltage and Waveforms. Often the defective component can be located by checking for the correct voltage or waveform in the circuit. Typical voltages and waveforms are given in the Diagrams section.

NOTE

Voltages and waveforms given on the diagrams are not absolute and may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the back side of the Diagrams Title page.

CAUTION

Due to the component density on the circuit boards, care should be taken with meter leads and probe tips. Accidental shorts can cause abnormal voltages or transients that may destroy many components.

WARNING

"Ground lugs" are not always at ground potential. Check the diagrams before using such connections as a ground for the voltmeter test prod or oscilloscope probe. Some transistor cases may be at voltages that can cause an electrical shock.

8. Check Individual Components. The following procedures describe methods of checking components in the 148-M. Components that are soldered in place should be checked without removal, by isolating the component if circuit conditions allow. If component isolation is questionable, unsolder one end.

a. Transistors. The best check of transistor operation is actual performance under operating conditions. If a transistor is suspected of being defective, it can best be

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checked by substituting a new transistor. However, be sure that circuit conditions are not such that a replacement might also be damaged. If substitute transistors are not available, use a dynamic tester such as the TEKTRONIX Type 576.

b. Diodes. A diode can be checked for an open or shorted condition by measuring the resistance between terminals. Use the Rx 1 k scale of an ohmmeter. The resistance should be very high with the leads across the diodes in one direction, and very low when they are reversed.

CAUTION

Do not use an ohmmeter range that has a high internal current. High current may damage some signal diodes. Never test tunnel diodes or back-diodes with an ohmmeter.

9. Repair and Readjust the Circuit. If any defective component or part is located, follow the replacement procedure given in this section. Be sure to check the performance of any circuit that has been repaired or that has had any electrical components replaced.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques or procedures required to replace components in this instrument are described here.

Obtaining Replacement Parts

All electrical and mechanical replacement parts for the 148-M can be obtained through your local TEKTRONIX Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order from Tektronix, Inc. Before purchasing or ordering replacement parts, consult the Parts List for value, tolerance, and rating.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance at high frequencies.

Multiple Terminal Connector Holders. Most inter-circuit connections between the circuit boards, or between the boards and the chassis-mounted components, are made through pin connectors. The terminals in the connector holder are identified with numbers. Connector orientation to the circuit board is keyed with triangles, one on the holder and one on the circuit board. See Fig. 4-2.

Circuit Boards. If the circuit board is damaged beyond repair, the entire assembly, including all soldered-on components, can be replaced.

Transistor and Integrated Circuit Replacement. Transistors and integrated circuits (IC's), should not be replaced unless they are actually defective. Replacement or exchange of components may affect the calibration of the instrument. If a transistor or integrated circuit is removed during routine maintenance, return it to its original socket.

Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket and cut the leads to the same length as on the component being replaced. See Fig. 4-3 for basing diagrams.

The chassis-mounted power-supply transistors and their mounting bolts are insulated from the chassis. In addition, silicone grease is used to increase heat transfer capabilities. Re-install the insulators and replace the silicone grease when replacing these transistors. The grease should be applied to both sides of the mica insulators, and should be applied to the bottom side of the transistor where it comes in contact with the insulator.

WARNING

Voltages are present on the exterior surface of the chassis-mounted power supply transistors if the power is applied to the instrument and the POWER switch is on.

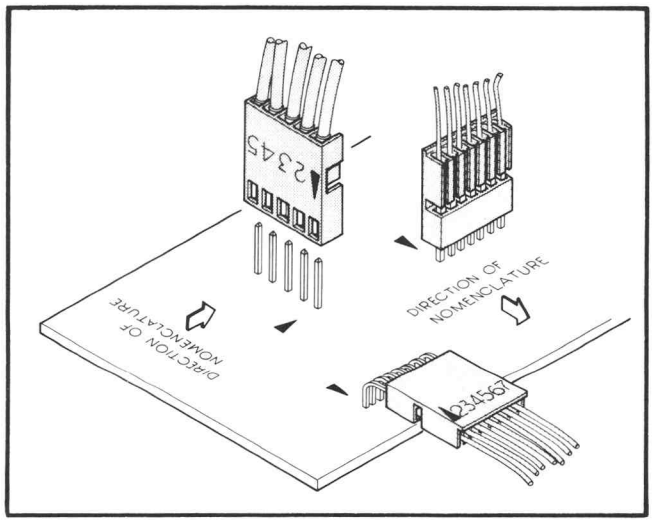

Fig. 4-2. Multipin circuit board connectors.

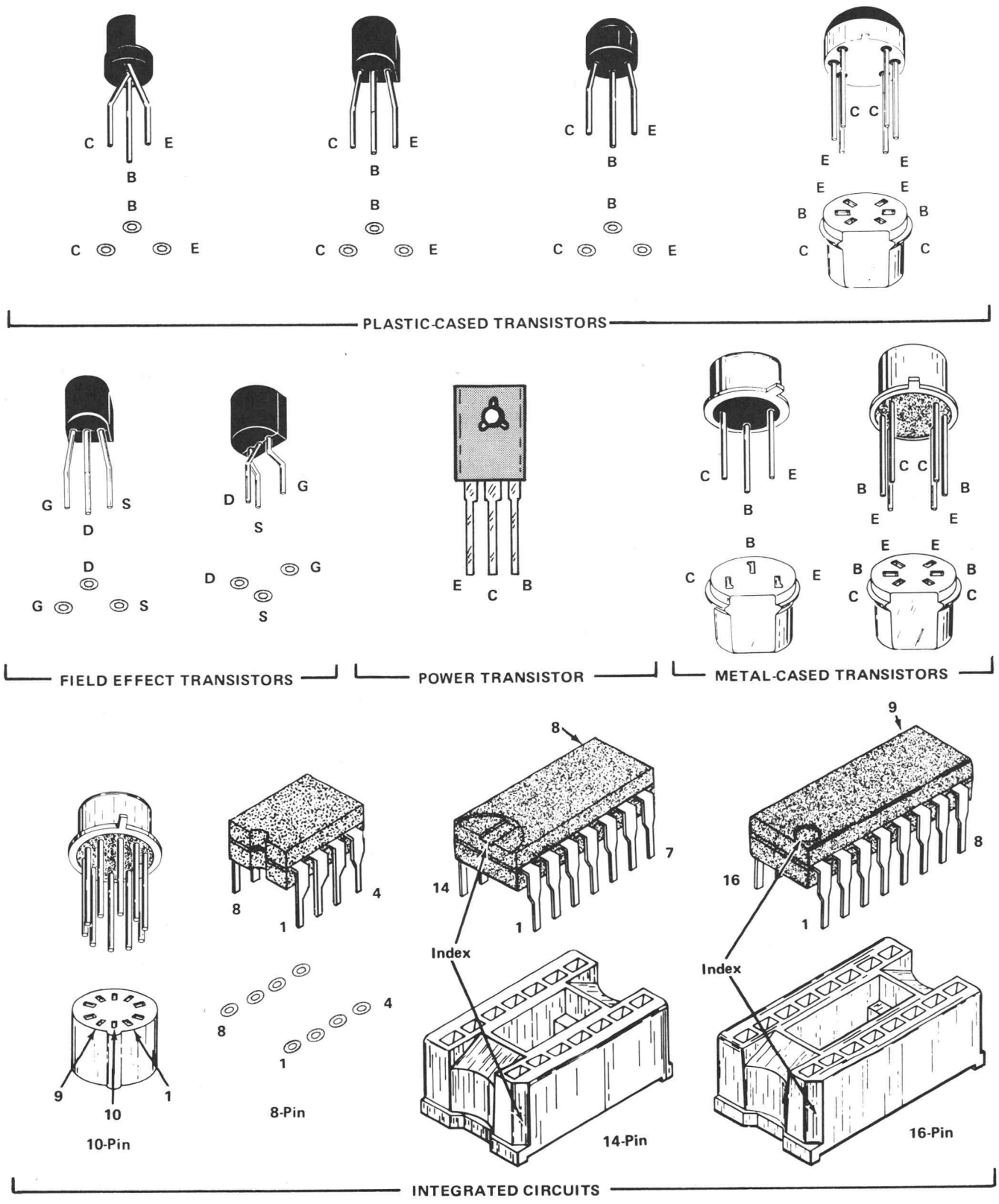

Fig. 4-3. Transistor and Integrated Circuit basing diagrams.

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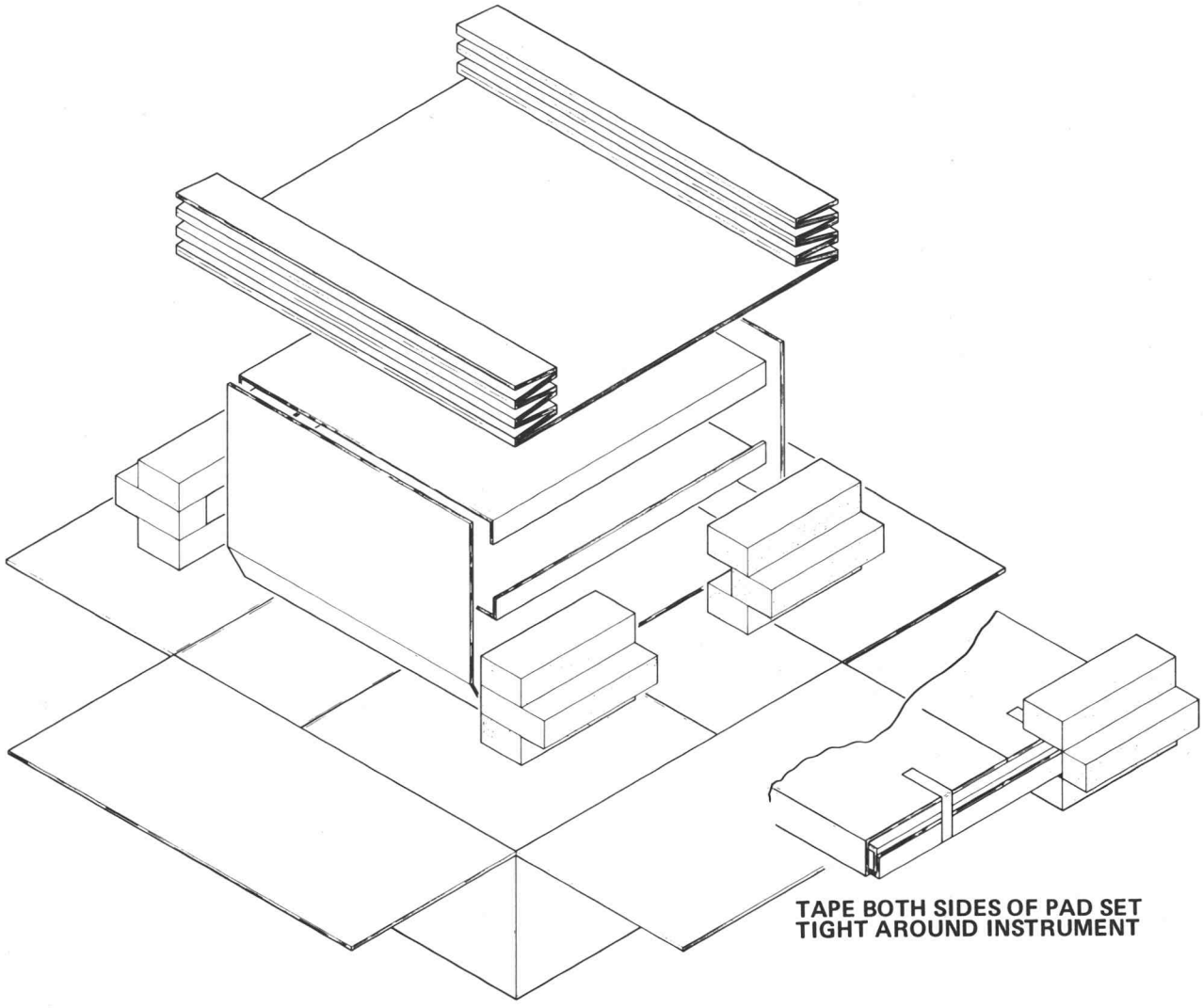

Repackaging for Shipment:

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

1. Obtain a carton of corrugated cardboard having inside dimensions of no less than six inches more than the instrument dimensions; this will allow for cushioning. Refer to Table 1 for carton test strength requirements.
2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.
4. Seal carton with shipping tape or industrial stapler.

Table 1. Shipping Carton Test Strength.

Gross Weight (lb.)	Carton Test Strength (lb.)
0 – 10	200
10 – 30	275
30 – 120	375
120 – 140	500
140 – 160	600

1929-17

Fig. 4-4. Repackaging instructions.

After any component is replaced, check the operation and calibration of the associated circuits.

Indicator Lamp Replacement. To remove the POWER ON indicator lamp, remove the top dust cover from the instrument, then reach behind the front-panel and unplug the lamp from its socket. To replace the lamp, reverse the procedure.

The NOT LOCKED TO PROGRAM, PROGRAM, PREVIEW, and BYPASS indicators consist of two parts; a lens that is attached to the instrument, and a lens cap (connected to the back of the lens) into which the lamps have been soldered. To remove the lamps, reach behind the front-panel, grasp the lens cap and pull straight away from the front-panel. The lens cap will unsnap from the lens, allowing lamp access. Unsolder the lamp. To replace, solder the new lamp into the lens cap. Then place the lens cap on the back of the lens and apply enough pressure to snap the cap into place over the lens.

Fuse Replacement. Both line fuses are contained in plastic holders in the cover for the Line Voltage Selector Assembly at the rear of the instrument. Use only the correct value replacement fuse. Only the upper fuse within the assembly (3/4 A) is used for 115-volt operation. However, for 230-volt operation both the upper and lower fuse (1/2 A) must be installed.

Switches. If a switch is defective, replace the entire assembly. Replacement switches can be ordered by referring to the Parts List for the applicable part numbers.

Power Transformer Replacement. If the power transformer becomes defective, contact your local TEKTRONIX Field Office or representative for replacement. Replace only with a direct replacement TEKTRONIX transformer.

Power Input Connector and RFI Filter Replacement. The Power Input Connector and RFI Filter is replaceable as a unit and repair should not be attempted. If replacement is necessary, observe proper polarity to ensure instrument protection.

The narrow blade (terminal number 4) should show continuity to terminal number 3, which connects to fuse F9201 (see diagram 11). (The filter contains an internal non-replaceable fuse between these two terminals.) Use care when soldering to terminals numbers 1 and 3, as excess solder could possibly short the filter case.

CALIBRATION

This portion of the manual contains the adjustment sequence for calibrating the 148-M to the performance requirements listed in the Specification section. Limits, tolerances, and waveforms in this procedure are given as calibration guides and are not instrument specifications, unless given in the Specification section.

The Short Form Inspection Procedure is provided so that those familiar with the long-form calibration can check instrument specification without following the step-by-step procedure. Those unfamiliar with the 148-M should follow the complete calibration procedure, omitting all adjustments, to check instrument performance.

SHORT FORM INSPECTION PROCEDURE

		Group	Step
1. CW SUBCARRIER OUT			
Output	2 V ±10%	1	5
2. COMPOSITE SYNC OUT			
a. Aberrations	≤4%	1	6
b. Amplitude	4 V ±10%	1	6
3. OUTPUT AMPLITUDES			
a. FLAT FIELD, 100% PEAK WHITE	700 mV ±1%	2	2
SYNC	−300 mV ±1%	2	3
Output DC level	0 V ±50 mV	2	4
FLAT FIELD (front)	700 mV ±1%	2	5
b. FULL FIELD SIG Timing (see Fig. 1-2)		2	6

SHORT FORM INSPECTION PROCEDURE (cont)

		Group	Step
4. LUMINANCE			
a. LINEARITY			
RAMP	700 mV ±1%	3	1a
10 STEPS	700 mV ±1%	3	1b
5 STEPS	700 mV ±1%	3	1c
b. SIG-III			
Bar	700 mV ±1%	3	2
c. CCIR-II			
MB White Ref Pedestal	700 mV ±1%	3	3a
CCIR-II Center Level	350 mV ±5 mV	3	3b
d. FLAT FIELD Amplitudes			
FIELD SQ. WAVE	700 mV ±1%	3	4a
PRESET—WHITE	595 to 700 mV	3	4b
BLACK	0 to 105 mV	3	4c
BOUNCE	BLACK to WHITE	3	4d
BOUNCE RATE	≤1 sec. to ≥10 sec.	3	4e
e. NOISE PEDESTAL Amplitudes			
700 mV	700 mV ±2%	3	5a
350 mV	350 mV ±2%	3	5b
50 mV	50 mV ±5 mV	3	5c
5. MODULATOR			
a. Residual Subcarrier	≤2.5 mV	4	1
b. Bandpass Filter	Straight vectors, narrow openings	4	2
c. Harmonics	≥40 dB down	4	3
d. Phasing			
Signal Modulation	180° ±5°	4	4a
+V Burst	135° ±1°	4	4a
−V Burst	225° ±1°	4	4b
Difference between Bursts	90° ±1°	4	4c
6. CHROMINANCE			
a. Burst Amplitude	300 mV p-p ±3%	5	1b
b. LINEARITY Modulation			
100 mV	100 mV p-p ±1%	5	2a
140 mV	140 mV p-p ±1%	5	2b
c. CCIR-I Modulation	280 mV p-p ±1%	5	3
d. CCIR-II Modulated Pedestal			
Level 1	140 mV p-p ±1%	5	4a
Level 2	280 mV p-p ±1%	5	4b
Level 3	560 mV p-p ±1%	5	4c

SHORT FORM INSPECTION PROCEDURE (cont)

		Group	Step
e. Chrominance Risetimes			
Burst	375 ns ±50 ns	5	5a
CCIR-II Modulated Pedestal	400 ns ±25 ns	5	5b
f. MOD PULSE & BAR			
12.5T Pulse, Half Amplitude Duration	1.57 μs ±50 ns	5	6b
Baseline Ripple	≤3.5 mV	5	6c
Amplitude (pulse-to-bar ratio)	100% ±1%	5	6d
Luminance Components	350 mV ±2%	5	6e
7. PULSE AMPLITUDE AND WIDTH			
a. 2T Pulse			
Amplitude (pulse-to-bar ratio)	100% ±1%	6	1a
Width (HAD)	250 ns ±15%	6	1b
b. T Pulse			
Amplitude (pulse-to-bar ratio)	100% ±1%	6	2
Width (HAD)	125 ns ±15%	6	2
c. Bar Risetimes			
T Bar	115 ns ±15%	6	3
2T Bar	225 ns ±15%	6	3
8. MULTIBURST			
a. Harmonics	40 dB down	7	1
b. Frequencies	500 kHz ±3% 1.0 MHz ±3% 2.0 MHz ±3% 3.0 MHz ±3% 3.57 MHz ±3% 4.2 MHz (+0%, −2%)	7	2
c. MB Length	Cycles start and stop at center	7	3
d. Flatness			
350 mV	±0.5% of 500 kHz amplitude	7	4a
700 mV	±0.5% of 500 kHz amplitude	7	4b
e. MB Average Level	4.2 MHz level matches reference level on 522A	7	5
f. MB Sync Level	Horizontal and vertical sync levels match.	7	6
g. MB Amplitudes			
700 mV	700 mV ±1%	7	7a
350 mV	350 mV ±1%	7	7b

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SHORT FORM INSPECTION PROCEDURE (cont)

		Group	Step
9. FIELD RATE SWEEP GEN			
a. Timing	≈1 MHz/marker	8	1
b. Amplitudes			
Pedestal	350 mV ±5 mV	8	2a
350 mV	350 mV ±1% to 6 MHz	8	2b
700 mV	700 mV ±1% to 6 MHz	8	2c
10. FULL FIELD DIFF GAIN & PHASE			
a. Diff Gain	≤0.5%	9	1
b. Diff Phase	≤0.2°	9	2
11. NOISE			
a. Amplitude	−20 dB to −59 dB ±1 dB	10	1b
b. Half-line Insertion	(NOISE INSERTION)	10	2
Full-line Pedestal	(NOISE DELETION)	10	2
c. Noise Match	PROGRAM LINE noise matches half-line inserted noise	10	3b
d. VARIABLE Pedestal	±50 mV from pedestal, except, +50 mV and −36 mV from the 50 mV pedestal	10	4a
e. Baseline Transients	≤32 mV	10	4b
f. Noise Spectrum	Flat to 5 MHz ±6 dB	10	5
12. GEN LOCK			
a. NOT LOCKED TO SYNC Light	On when no sync input	11	1b
b. Outputs	No COMP SYNC or CW SUB-CARRIER when no comp sync input	11	1b
	No CW SUBCARRIER when no incoming burst or subcarrier	11	1b
c. INT/EXT Mode	TP5698 pulses are same for INT or EXT modes	11	2b
	Loss of any input removes pulses at TP5698	11	2b
d. Sync Stripper	TP5970—5 to 6 V of comp sync in INT or EXT	11	3
	TP5282 amplitude is always 0.8 to 1.2 volts, with or without comp sync	11	3
e. Chroma AGC Ratio	1:1.6	11	4
f. 3.57 MHz Frequency	3.57561149 MHz ±25 Hz	11	5
g. Sound Inhibit	275 ns before end of sync	11	6

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SHORT FORM INSPECTION PROCEDURE (cont)

	Group	Step
13. VITS INSERTION—DIFF PHASE & GAIN		
a. PROGRAM OUTPUT LINE: diff phase, ≤0.15° and diff gain, ≤0.2%	12	1b, 1c
VAR LEVEL at Max: diff phase, ≤0.3° and diff gain, ≤0.4%	12	1d
b. PREVIEW OUTPUTS: diff phase, ≤0.3° and diff gain, ≤0.4%	12	2
14. VITS INSERTION		
a. PROGRAM OUTPUT LINE		
Gain Change Between PROGRAM, PREVIEW & BYPASS: Unity gain ±1%, all signals	13	2c
DC Level: within 50 mV of BYPASS LEVEL	13	2b
PROGRAM FLATNESS: within 1% of FF TEST SIGNAL	13	4b
PROGRAM VITS Flatness: within 1% of FF TEST SIGNAL	13	4b
b. PREVIEW OUTPUTS		
Gain, PROGRAM OUTPUT LINE to PREVIEW MONITOR OUT: Unity gain ±1%	13	3c
DC Level: within 50 mV of BYPASS LEVEL	13	3b
PREVIEW VITS Flatness: within 1% of FF TEST SIGNAL	13	4a
PREVIEW Flatness: within 1% of FF TEST SIGNAL	13	4a
Other PREVIEW OUTPUT		
c. INSERT SUBCARRIER PHASE		
≥5° either side of 180°	13	5a
Set for no error, PROGRAM	13	5b
No error, PREVIEW	13	5b
d. Unwanted VITS Pedestal		
PROGRAM & PREVIEW: ≤5 mV	13	2b
e. Amplitude Ratio, PROGRAM	13	2e
2T Pulse-to-Bar: 100% ±0.25% (1.8 mV)		
12.5T Pulse-to-Bar: 100% ±0.5% (3.5 mV)		
12.5T Luminance to Chrominance Change: ≤0.5%		
f. Frequency Response		
±1% to 5 MHz	13	6g
g. Waveform Tilt, PROGRAM & PREVIEW	13	10
26 μs Bar: ≤0.5%		
FIELD Rate SQ WAVE: ≤0.5%		
Line Tilt: ≤0.25%		
15. AUXILIARY PEDESTAL & UNITY GAIN—VAR LEVEL		
a. AUXILIARY PEDESTAL	13	11
≥−70 mV to ≥630 mV		
b. UNITY GAIN—VAR GAIN	13	12
≤70% to ≥140%, PROGRAM & PREVIEW		
c. Bypass Relay	14	4a, 4b

SHORT FORM INSPECTION PROCEDURE (cont)

	Group	Step
16. PROGRAM LINE OUT—ABERRATIONS		
a. Residual Subcarrier: −60 dB (≤0.7 mV)	13	13a
b. Inactive Part of Lines: −40 dB (≤7 mV)	13	3b
c. Active Part of Lines		
Spurious: −60 dB (≤0.7 mV)	13	13c
FF 2T Pulse: −70 dB (≤0.22 mV)	13	13d
FF Subcarrier (Staircase): −60 dB (≤0.7 mV)	13	13d
All Other FF Signals: −60 dB (≤0.7 mV)	13	13d
d. Delete Mode		
2T (from 148-M): −70 dB (≤0.22 mV)	13	13g
Subcarrier (Color Bars): −60 dB (≤0.7 mV)	13	13g
Any Int Signal (Rotate FF Switch): −60 dB (≤0.7 mV)	13	13g
e. Non-inserted Lines		
Hum & Power Line Transients: −60 dB (≤0.7 mV)	13	13e
f. Random Noise		
−75 dB (0.14 mV or less)	13	13f
17. INSERT DELAY & TIMING		
a. Delay: Start of Sync to Start of NOISE or MB VITS, 11.5 to 12.5 μs with INSERT DELAY adjustment.	14	3a
b. INSERT DELAY Range: 1.5 μs or more	14	1a
c. Serration Width: 4.5 μs ±0.2 μs Sync Width: 4.71 μs ±0.05 μs Equalizer Width: 2.4 μs ±0.1 μs	14	2
18. RETURN LOSS		
a. PROGRAM LINE, POWER Off		
At least −30 dB (≤7.5 mV) to 5 MHz	15	3c

CALIBRATION PROCEDURE

General

The calibration procedure is arranged in a sequence designed for calibration with minimum interaction of adjustments and reconnection of equipment. However, some adjustments affect the calibration of other circuits, and it may be necessary to check the operation of other parts of the instrument. Where adjustments interact, they are noted.

The procedure uses the equipment and fixtures listed in the Test Equipment Used list. If test equipment is substituted for that on the list, control settings, setups, and methods of measuring may have to be altered.

The 148-M front- and rear-panel control titles and signal output connectors are capitalized (i.e., COMP SYNC). Internal adjustment titles are initial capitalized only (i.e., Subcarrier Ampl.).

Test Equipment Used

All test equipment is assumed to be correctly calibrated and operating within the given specification.

Test Equipment for Adjustment Steps

1. Waveform Monitor. TEKTRONIX 1482 Waveform Monitor. If a 1480-Series monitor is not available, a test

oscilloscope with differential inputs, and the Chopped Voltage Reference listed in the optional test equpment list should be used.

2. Vectorscope. TEKTRONIX 522A PAL-M Vectorscope or equivalent.

3. Test Oscilloscope. Bandwidth, dc to at least 30 MHz; delaying time base; and vertical deflection factor of at least 5 mV/Div. TEKTRONIX 7603 Oscilloscope with 7A18 Dual Trace Amplifier and 7B53A Dual Time Base or equivalent.

4. Video Signal Source. Signals: PAL-M color bars or modulated staircase (5 steps and 140 mV subcarrier) and VITS insertion; composite sync, subcarrier, PAL pulse, and burst flag. TEKTRONIX 145-M PAL-M Test Signal Generator or equivalent.

5. DC Voltmeter. Capable of measuring 5 and 15 volts within 1%. TEKTRONIX DM 501 or equivalent.

6. Coaxial CABLES (7). 75 Ω with BNC connectors (cable). TEKTRONIX Part No. 012-0074-00 or equivalent.

7. Terminations (3). 75 Ω end-line, with BNC connectors (end-line termination). TEKTRONIX Part No. 011-0102-00 or equivalent.

8. Terminations (2). 75 Ω feed-through with BNC connectors (feed-through termination). TEKTRONIX PART No. 011-0103-02 or equivalent.

9. RMS Voltmeter. Capable of measuring 70 mV to 0.14 V. HEWLETT-PACKARD Model 3400A or equivalent.

10. Filter. Continuous Random Noise Measurement Low Pass Filter, $F_c = 4.2$ MHz. (4.2 MHz Low Pass Filter.) TEKTRONIX Calibration Fixture 015-0212-00 or equivalent.

11. Spectrum Analyzer. Center frequency, 0.1 MHz; resolution, 100 kHz; frequency span, at least 2 MHz/div; RF attenuation range, capable of measuring 40 dB below the reference signal. TEKTRONIX 1401A or equivalent.

Optional Test Equipment

12. Variable Autotransformer. Power supply regulation. Capable of supplying at least 200 volt-amperes over the desired line voltage range. GENERAL RADIO W10MT3W Metered VARIAC Autotransformer or equivalent.

13. Weighting Network. Program Line Out aberrations. Continuous Random Noise Measurement Weighting Network, $F_c = 4.2$ MHz. (4.2 MHz Weighting Network.) TEKTRONIX Calibration Fixture 015-0214-00 or equivalent.

14. Test Oscilloscope. Bandwidth dc to at least 30 MHz; minimum deflection factor, 1 mV/division; two input channels capable of independent or differential operation; time base, at least 0.1 μs/division and slower. TEKTRONIX 7603 Oscilloscope with 7A13 and 7B53A plug-ins or equivalents.

15. Chopped Voltage Reference. TEKTRONIX Calibration Fixture 067-0596-00 (chopper) or equivalent. Use if 1482 Waveform Monitor is not available.

16. Sinewave Generator. Return loss and frequency response. Output of at least 500 mV; frequency range, 50 kHz reference and variable from 1 MHz to 6 MHz. TEKTRONIX SG 503 Leveled Sinewave Generator or equivalent (signal generator).

17. Return Loss Bridge. Use with differential amplifier and signal generator. TEKTRONIX Part No. 015-0149-00.

18. Minimum Loss Attenuator, 50 Ω to 75 Ω. Use with spectrum analyzer and signal generator. TEKTRONIX Part No. 011-0057-00.

Preliminary Procedure

1. Install the rear-panel REMOTE plug P9014. Allow a ten minute warmup at 25°C ±5°C before checking or calibrating the instrument.

2. Set the 148-M switches to the up or to the right position, except:

BURST	NORM
NOISE	OFF
FULL FIELD SIG (left)	LINEARITY
FULL FIELD SIG (right)	FLAT FIELD
% PEAK WHITE	100
FLAT FIELD	VAR APL

3. Connect an external 1-volt peak-to-peak composite video signal to the 148-M PROGRAM INPUT.

NOTE

Unless otherwise noted, connections made to the 148-M are via a 75 Ω coaxial cable.

4. From the 148-M rear-panel FULL FIELD TEST SIGNAL OUT connector, connect a cable to the monitor A Input; loop-through, with another cable, to the vectorscope A Input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

NOTE

Unless otherwise stated, 148-M signals to the test oscilloscope are applied through a cable that is terminated with a feed-through termination at the test oscilloscope input.

5. Externally trigger the test oscilloscope with composite sync.

6. Connect the video signal source composite sync signal to the monitor Ext Sync Input; connect the loop-through, with another cable, to the vectorscope Ext Sync Input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

7. Connect the video signal source subcarrier to the vectorscope Ext ϕ Ref Input; terminate the vectorscope loop-through with a 75 Ω end-line termination.

NOTE

Preliminary steps 2 through 7 are the basic setup for this procedure. If no setup is given at the start of a step, use this one.

GROUP 1—INITIAL

NOTE

Do not adjust the power supplies if they are within the listed tolerances. Adjustment of any supply will affect the operation of other circuits within the instrument. If a complete recalibration is being performed, set each voltage to the exact setting.

1. Check/Adjust Power Supply Voltage

a. Connect a precision dc voltmeter between chassis ground (pin 1 of P9834) and P9852 (−15 V), see Fig. 4-5.

CHECK—Voltage should be −15 V within 1% (−14.85 to −15.15 V).

ADJUST—R9851 (−15 Volt Adj) for −15 V.

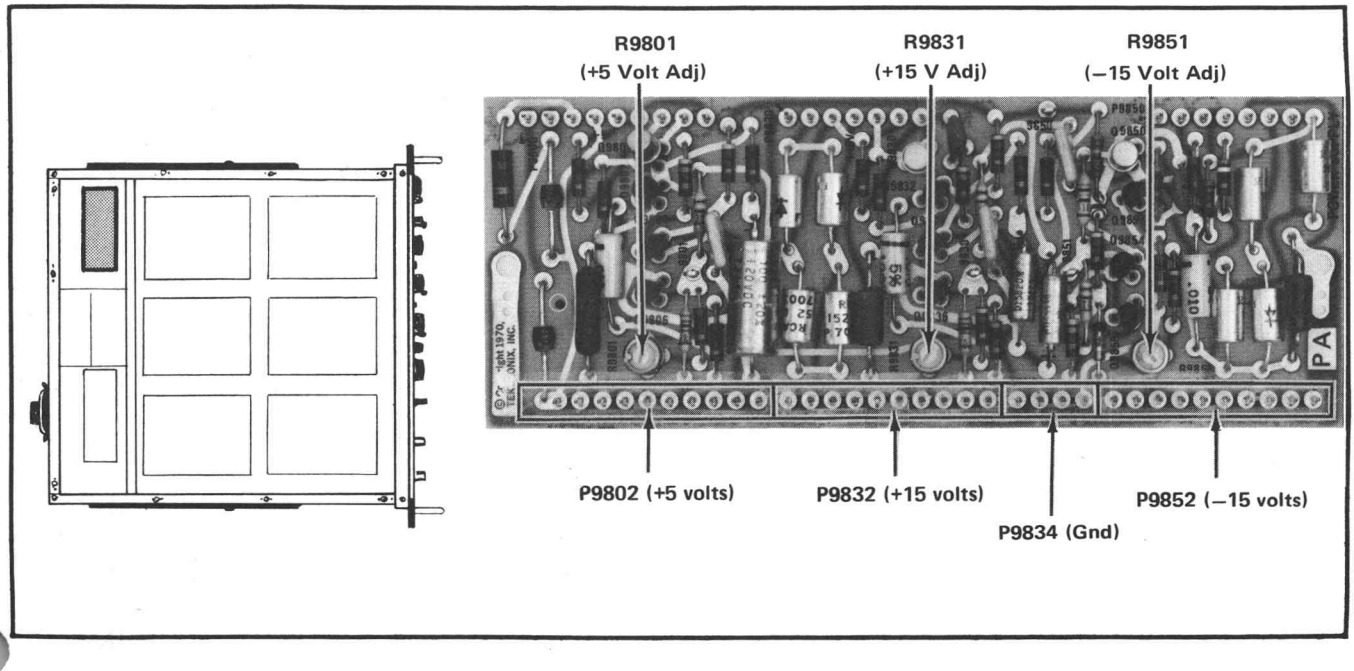

Fig. 4-5. Power Supply test point and adjustment locations.

b. Connect the voltmeter between chassis ground and P9832 (+15 V).

CHECK—Voltage should be +15 V within 1% (14.85 to 15.15 V).

ADJUST—R9831 (+15 Volts Adj) for +15 V.

c. Connect the voltmeter between chassis ground and P9802 (+5 V).

CHECK—Voltage should be +5 V within 1% (4.95 to 5.05 V).

ADJUST—R9801 (+5 Volts Adj) for +5 V.

d. Repeat the above adjustments to remove any interaction.

2. Check Power Supply Ripple

Use a 1X probe between the supply under test and the test oscilloscope.

CHECK—Power line related ripple at these plugs:

Plug	Supply	Max Ripple
P9852	−15 V	10 mV
P9832	+15 V	10 mV
P9802	+5 V	10 mV

3. Check/Adjust 1 MHz Oscillator Lock

Establish a 0-volt (ground) reference point on the test oscilloscope. Connect a 10X probe to TP1720, see Fig. 4-6.

CHECK—Display dc level should be approximately +2.5 V.

ADJUST—L1670 (1 MHz Osc) to position the display midway between the two levels at which the oscillator free-runs (one level near +5 V dc and the other near 0 V dc).

4. Check/Adjust INSERT DELAY Range

Connect the 10X probe to the back of the FULL FIELD TEST SIGNAL OUT connector. Display the full-field signal and establish a horizontal timing reference point.

CHECK—Rotation of the INSERT DELAY control, through its range, should move the display 1 μs or more.

ADJUST—INSERT DELAY control to electrical midrange.

5. Check/Adjust Subcarrier Amplitude

Display the 148-M CW SUBCARRIER OUT on the test oscilloscope.

CHECK—Subcarrier amplitude should be between 1.8 and 2.2 V peak-to-peak.

ADJUST—L190 (Subcarrier Ampl), see Fig. 4-7, for a subcarrier amplitude of 2 V peak-to-peak.

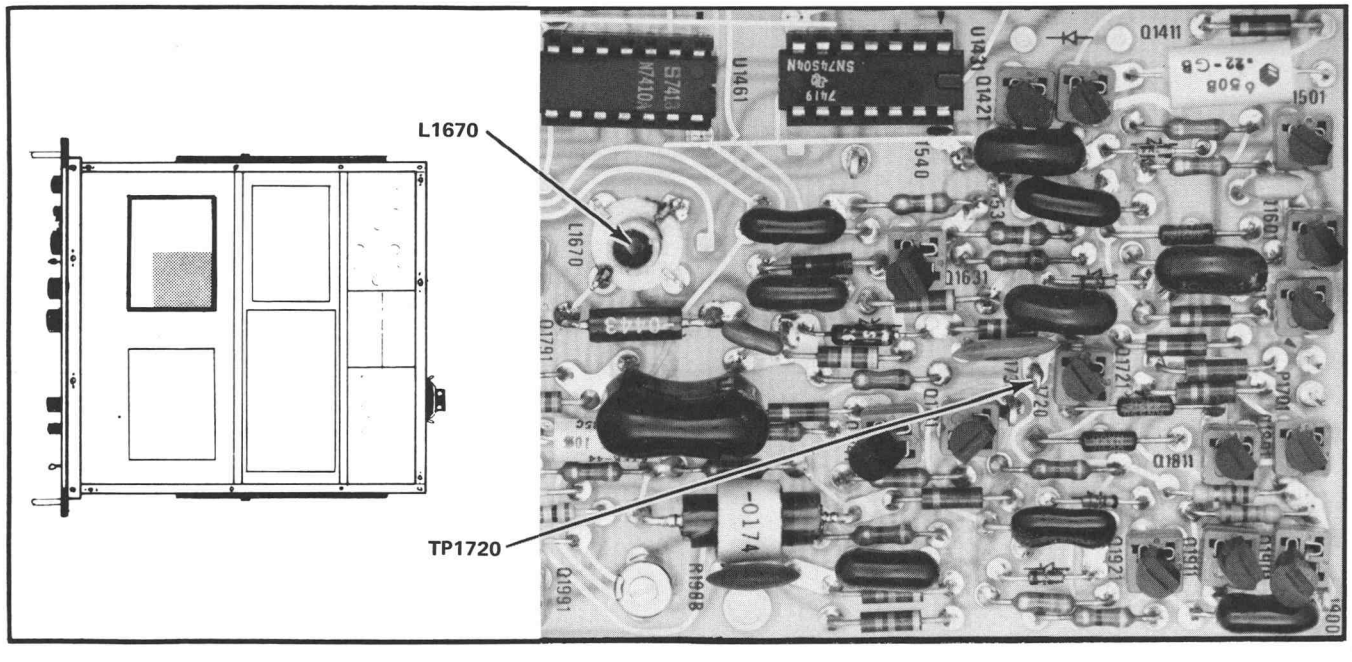

Fig. 4-6. Horizontal Counter test point and adjustment locations.

6. Check/Adjust Composite Sync

Display the 148-M COMP SYNC on the test oscilloscope.

CHECK—Composite Sync amplitude should be between 4 and 5 V peak-to-peak.

CHECK—Aberrations on leading corner of the sync should be 4%, or less, of the total amplitude.

ADJUST—L20 and L120 (Sync Filter), see Fig. 4-7, for the best square corner on the leading edge of sync with aberrations 4% or less.

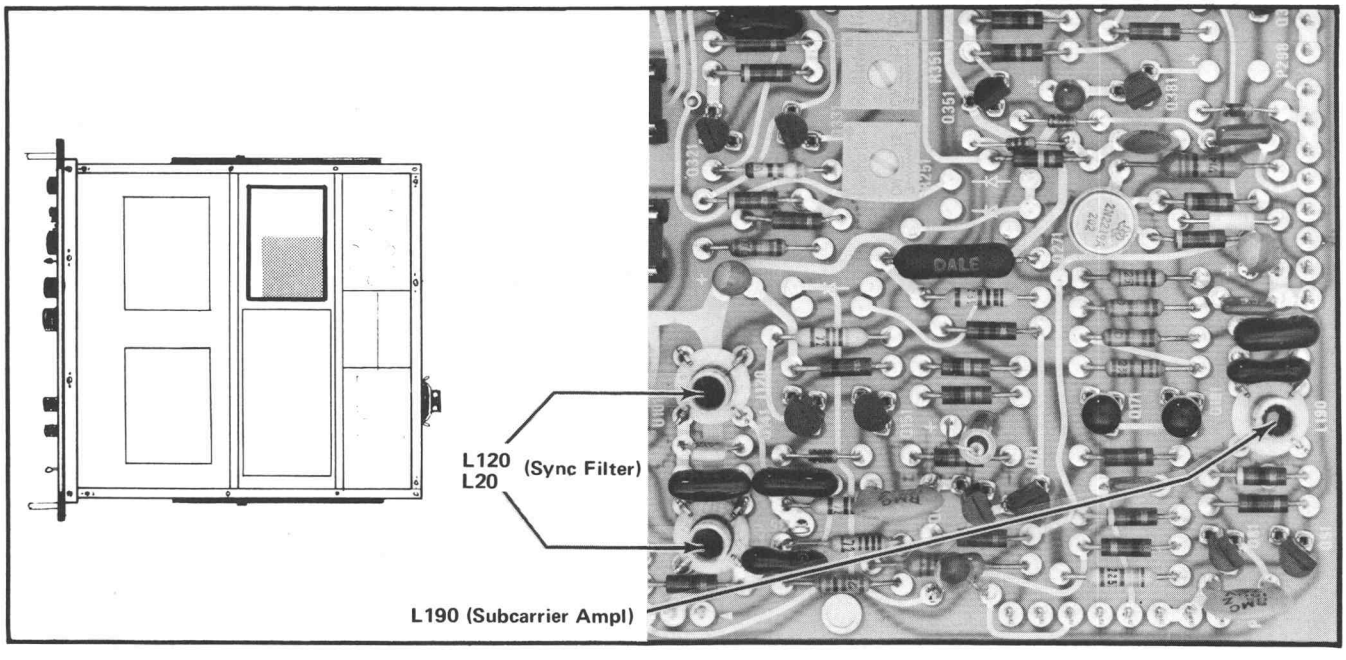

Fig. 4-7. Subcarrier & Sync filter adjustment locations.

GROUP 2—OUTPUT AMPLITUDES

1. Setup

Display the rear-panel FULL FIELD TEST SIGNAL on the A Input of the 1482 Waveform Monitor. Set the Waveform Monitor for Ch. A, DC Cpl'd, 0.2 Volt Full Scale, 10 μs/Div, Mag off, all grey pushbuttons in except DC Restorer is Off, and Waveform Comparison Off. Position the blanking level to midscreen.

Disconnect P8490 (see Fig. 4-8) to remove chrominance from the signal during this part of the procedure. Set R6942 (MB Sync Level, see Fig. 4-9) to match the horizontal and vertical blanking levels. Set R7453 (P & B Sync Level, see Fig. 4-10) to midrange.

Push the Back Porch DC Restorer button (700 mV Cal square-wave), and both the Oper and Cal buttons. Position the display to show the pedestal and the blanking level overlayed.

2. Check/Adjust Pedestal Amplitude

CHECK—Pedestal matches the blanking level within 3.5 minor divisions (700 mV within 1%).

ADJUST—R7735 (Reference Ampl, see Fig. 4-10), so the pedestal exactly overlays the blanking level (700 mV).

3. Check/Adjust Sync Amplitude

Push the 1482 Sync Tip DC Restorer button (1 V Cal square-wave). Position the display to show the overlayed sync tip and pedestal.

CHECK—Sync and pedestal overlays within 1.5 minor divisions (300 mV within 1%).

ADJUST—R8920 (Sync Ampl, see Fig. 4-8), so the sync and pedestal exactly overlay (300 mV within 1%).

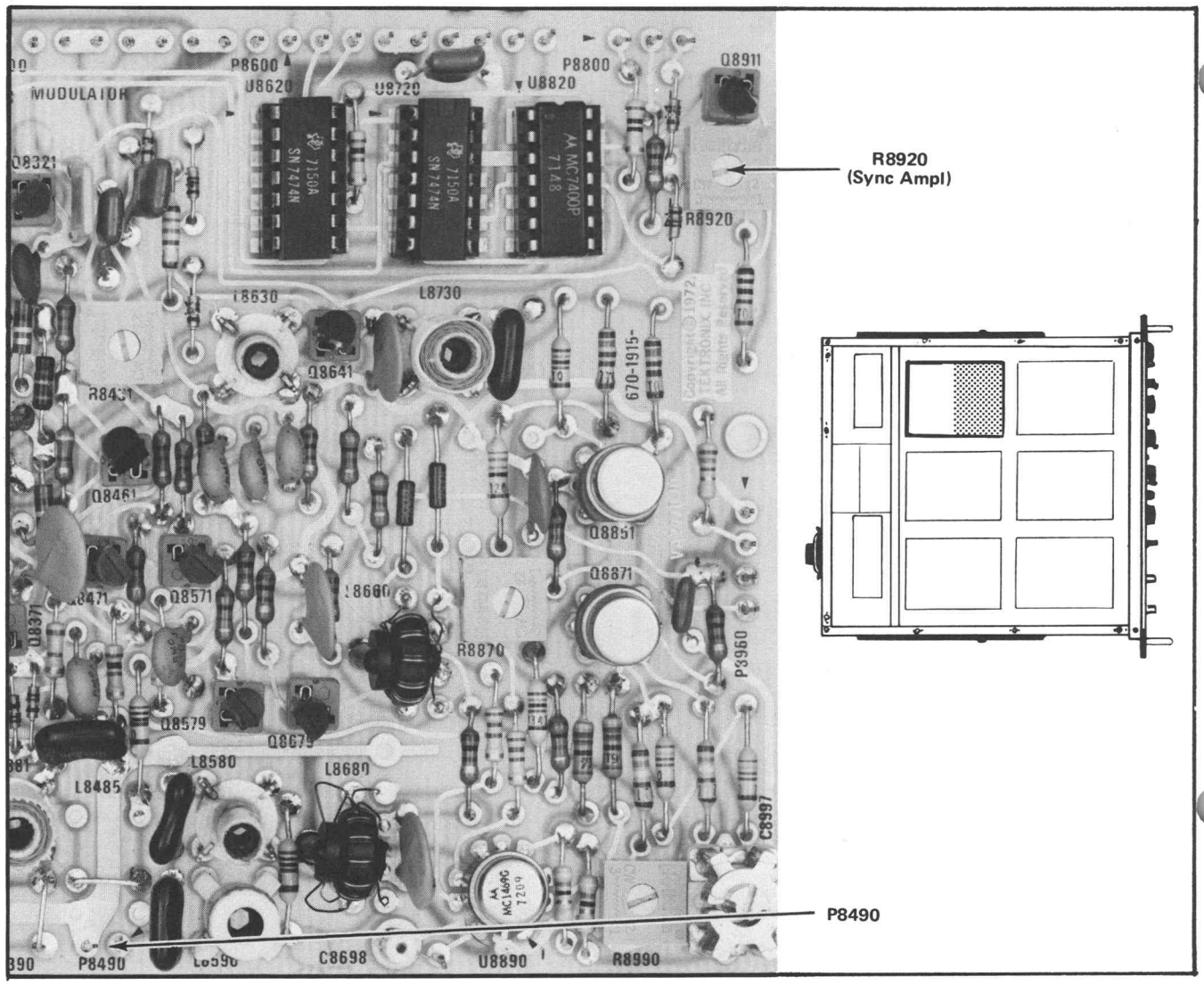

Fig. 4-8. Modulator circuit board locations of P8490 and Sync Ampl adjustment.

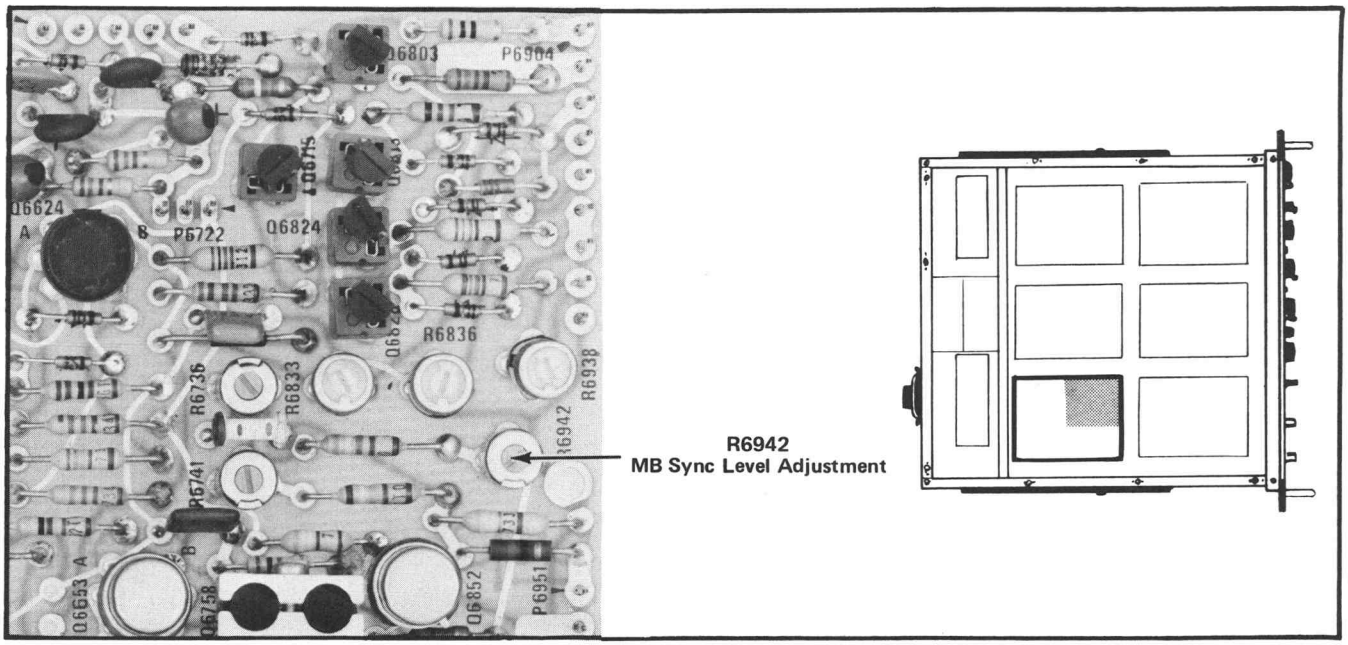

Fig. 4-9. Function Generator circuit board location of MB Sync Level adjustment.

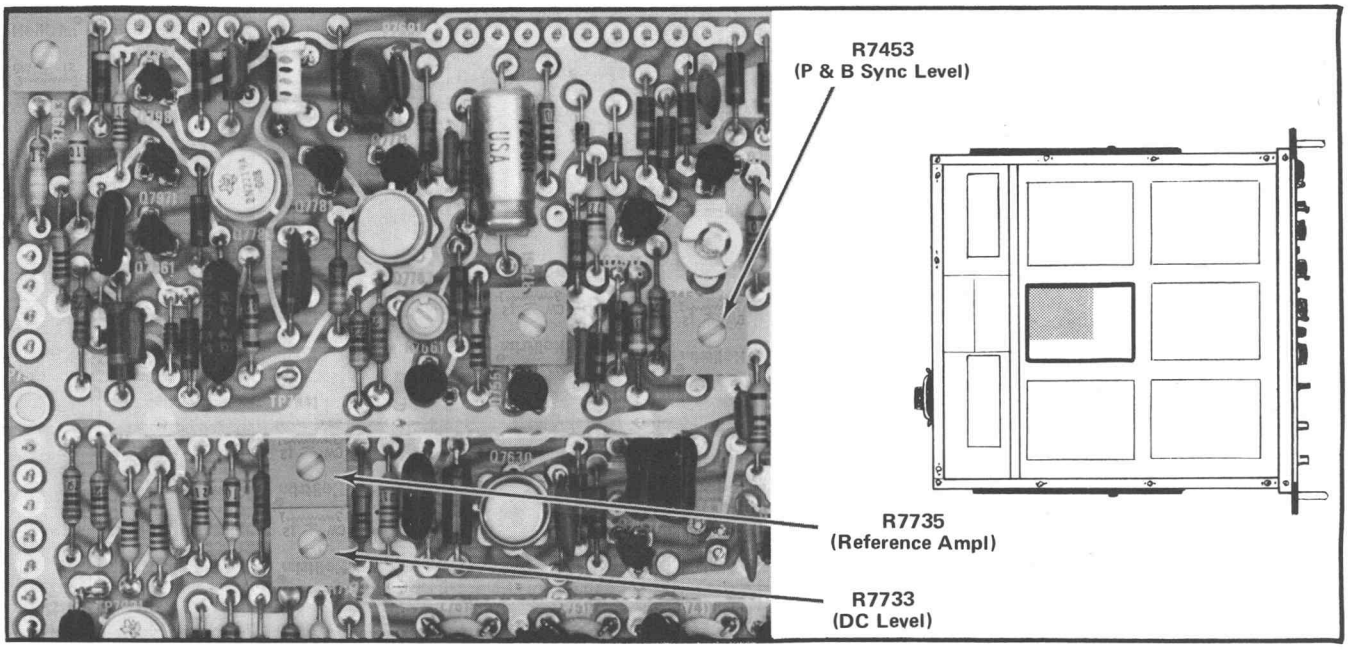

Fig. 4-10. Output Amplifier adjustment locations.

4. Check/Adjust Output DC Level

Push just the 1482 Oper button. Disconnect the FULL FIELD TEST SIGNAL temporarily. Set the 1482 Vertical Position to establish a ground reference on a horizontal graticule line. Reconnect the 148-M to the A Input.

CHECK—Blanking level is at the ground reference line within 2.5 major divisions (0 volt within 50 mV).

ADJUST—R7733 (DC Level, see Fig. 4-10) to position the blanking level to the ground reference line (0 volt).

5. Check FULL FIELD SIGNAL Outputs

Display the front-panel FULL FIELD TEST SIGNAL OUT on the 1482 Waveform Monitor. Push the Back Porch DC Restorer button (700 mV Cal) and both the Oper and Cal buttons.

CHECK—Pedestal amplitude is within 3.5 minor divisions of overlaying the blanking level (700 mV within 1%).

Return the rear-panel FULL FIELD TEST SIGNAL OUT to the A Input of the 1482. Set the 1482 for 1.0 Volt Full Scale.

6. Check Full-Field Signal Timing

Using Fig. 1-2 of this manual as a guide, check that each full-field signal generated by the 148-M is horizontally programmed as shown.

Return the 1482 to 0.2 Volt Full Scale.

GROUP 3—LUMINANCE

1. Check/Adjust LINEARITY Amplitudes

a. Set the 148-M FULL FIELD SIG Mode switch to ALT. Position the display (100% peak white alternating with the LINEARITY RAMP) so 100% PEAK WHITE is at a reference graticule line.

CHECK—LINEARITY RAMP peak matches the 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

ADJUST—R3616 (Ramp Ampl, see Fig. 4-11) to match the RAMP amplitude with the 100% PEAK WHITE (700 mV).

b. Set the 148-M LINEARITY switch to 10 STEPS.

CHECK—LINEARITY 10 STEPS peak matches 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

ADJUST—C3470 (10 Step Ampl, see Fig. 4-11) to match the 10 STEP amplitude with the 100% PEAK WHITE (700 mV).

c. Set the 148-M LINEARITY switch to 5 STEPS.

CHECK—LINEARITY 5 STEPS peak matches 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

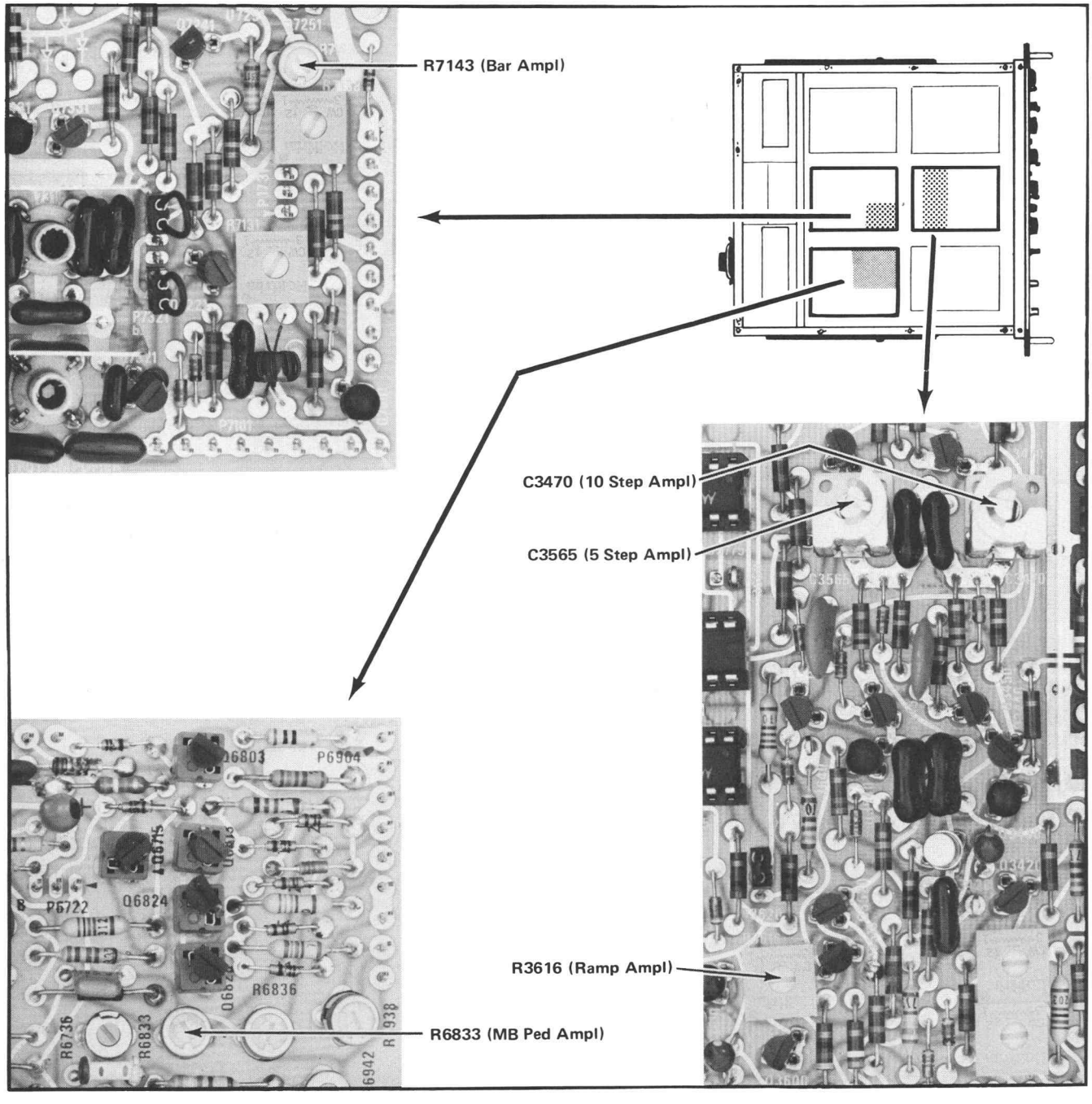

Fig. 4-11. Luminance adjustment locations.

ADJUST—C3565 (5 Step Ampl, see Fig. 4-11) to match the 5 STEPS amplitude with the 100% PEAK WHITE (700 mV).

2. Check/Adjust SIG-III Luminance Amplitudes

Set the 148-M for SIG-III alternating with FLAT FIELD VAR APL. Set the VAR APL switch for 100% PEAK WHITE.

CHECK—Bar matches 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

ADJUST—R7143 (Bar Amplitude, see Fig. 4-11) for bar to exactly match 100% PEAK WHITE (700 mV).

3. Check/Adjust CCIR-II Luminance Amplitudes

a. Set 148-M for CCIR-II signal alternating with 100% PEAK WHITE.

CHECK—MB White Reference Pedestal overlays 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

ADJUST—R6836 (MB Pedestal Amplitude, see Fig. 4-11) for MB White Reference Pedestal to exactly match the 100% PEAK WHITE amplitude (700 mV).

b. Set VAR APL switch to 50% PEAK WHITE.

CHECK—CCIR-II center level overlays the 50% PEAK WHITE within 2.5 minor divisions (350 mV within 5 mV).

4. Check FLAT FIELD Amplitudes

a. Set the FULL FIELD SIG Mode switch to ALL LINES, and VAR APL to 100% PEAK WHITE. Position 100% PEAK WHITE to horizontal reference graticule line on the 1482.

Set FLAT FIELD switch to FIELD SQ WAVE.

CHECK—Amplitude of FIELD SQ WAVE matches amplitude of 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

b. Set the 1482 for 1.0 Volt Full Scale. Position the blanking level to the horizontal reference graticule line. Set the 148-M FLAT FIELD switch to PRESET, and WHITE 85—100%.

CHECK—WHITE adjustment range is 85—100% (595 to 700 mV).

c. Set 148-M for BLACK 0—15%.

CHECK—BLACK adjustment range is 0 to 15% (0 to 105 mV).

d. Set 148-M for BOUNCE.

CHECK—Bounce level alternates between the selected white level and the selected black level.

e. Vary the BOUNCE RATE control.

CHECK—Bounce rate is variable from 1 second or less, at maximum cw, to 10 seconds or more at maximum ccw.

5. Check NOISE PEDESTAL Amplitude (Deletion)

a. Set the 148-M VAR APL and 100% PEAK WHITE. Set the 1482 to 0.2 Volt Full Scale. Position the 100% PEAK WHITE level to the horizontal reference graticule line.

Push the Dig (digital) button and set the Line Selector for line 14.

CHECK—NOISE PEDESTAL amplitude is within 7 minor divisions of the horizontal reference graticule line (700 mV within 2%).

b. Set the NOISE PEDESTAL to 350 mV, and VAR APL to 50% PEAK WHITE. Position the 350 mV pedestal to the reference line.

Push the 1482 Line Selector Off button.

CHECK—50% PEAK WHITE is within 3.5 minor divisions of the reference line (350 mV within 2%).

c. Set the 148-M for a 50 mV NOISE PEDESTAL. Push the Dig Line Selector. Position the blanking level 2.5 major divisions below the horizontal reference graticule line.

CHECK—The 50 mV NOISE PEDESTAL is within 2.5 minor divisions of the horizontal reference graticule line (50 mV within 5 mV).

GROUP 4—MODULATOR

1. Check/Adjust Residual Subcarrier

Connect P8490. Position the blanking level to the horizontal reference graticule line. Push the Line Selector Off button. Set the 148-M for 0% PEAK WHITE.

CHECK—Residual subcarrier is less than 1.25 minor divisions (less than 2.5 mV).

ADJUST—R8990, C8997, and C8698 for minimum residual subcarrier in all positions of the FULL FIELD SIG Selector. (See Fig. 4-12 for adjustment locations.)

2. Check/Adjust Bandpass Filter

Set the 148-M for the SIG-III signal. Observe the 522A Vectorscope.

CHECK—Vectors are straight lines with little or no openings.

ADJUST—L8580 and L8590 (see Fig. 4-12) for minimum vector openings and straight lines.

Recheck step 1 of this group for interaction.

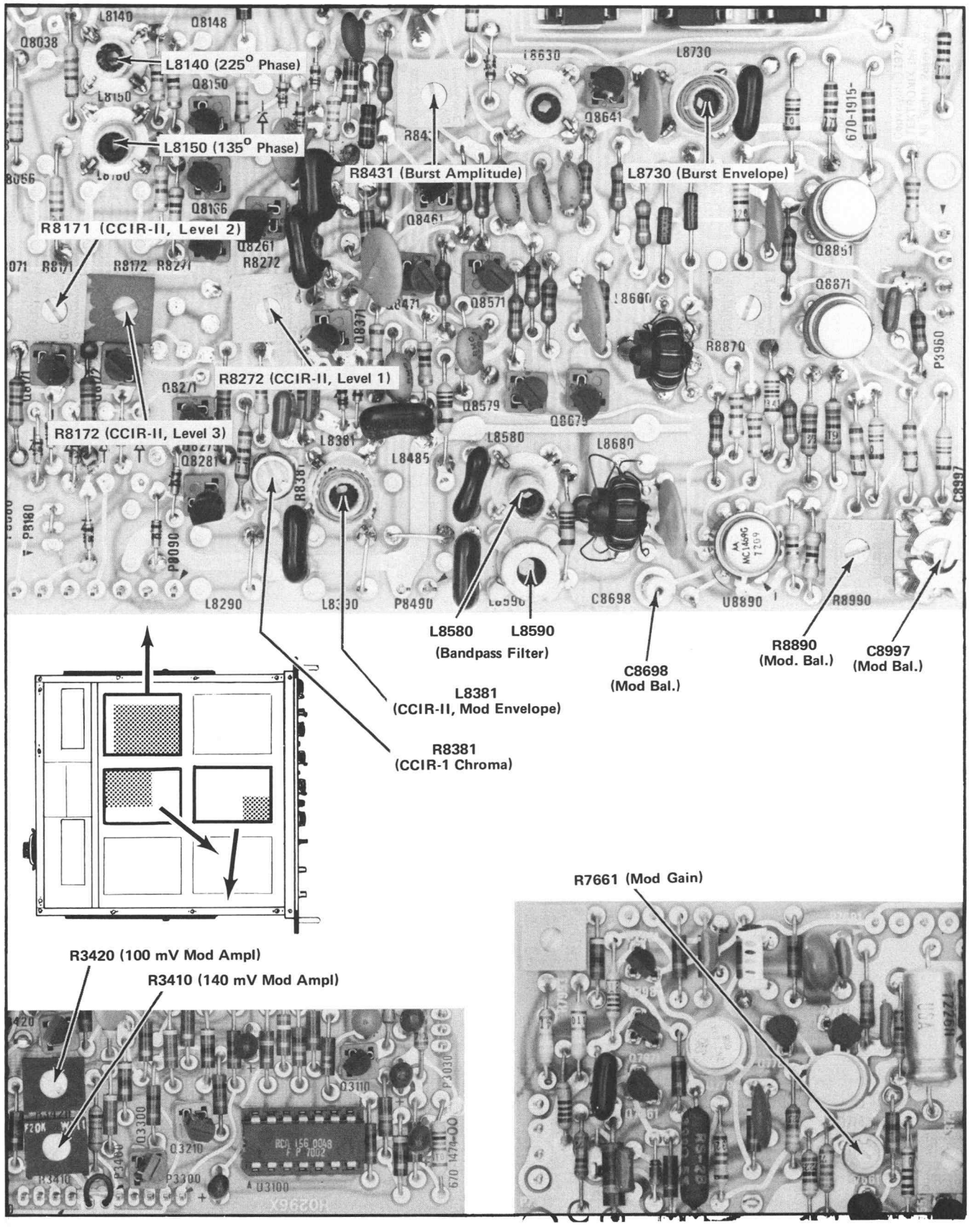

Fig. 4-12. Chrominance adjustment locations.

3. Check Harmonics

Connect the 148-M front-panel FULL FIELD TEST SIGNAL OUT to the input of a Tektronix 1401A Spectrum Analyzer (or equivalent). Connect the 1401A Video Out to the 1482 B Input. Connect the 1401A Sweep Voltage (5 V) to the 1482 External Horizontal Input (check the 1482 Instruction Manual for any special instructions for operating the External Horizontal function). Set the 1482 for 1.0 Volt Full Scale and Ext Display. Setup the 1401A as follows:

POWER	ON
RF ATTEN dB	20
IF GAIN	ccw
VERTICAL DISPLAY	LOG
CENTER FREQ MHz	
1—500	000
FINE	0
SWEEP MODE	FREE RUN
SWEEP RATE	≈10 o'clock
RESOLUTION kHz	100
FREQ SPAN	
MHz/DIV	.5
VAR (CAL IN)	pushed in
VIDEO FILTER	OFF

Allow a 20 minute warmup time for the batteries to charge on the 1401A.

To determine the −40 dB point, set the 1401A RF Atten to 10 dB, and adjust the IF Gain cw until the Multiburst frequencies are of maximum amplitude. Adjust the 1482 Var Volts Full Scale for 6 major divisions of signal. Set the 1401A RF Atten to 60 dB. Position the peaks of the Multiburst frequencies to the horizontal reference graticule line on the 1482. Set the 1401A back to 20 dB.

CHECK—Harmonics at all positions of the FULL FIELD SIG Selector are below the horizontal reference line (≥−40 dB).

If harmonics, other than Multiburst, are of more amplitude than −40 dB, repeat steps 1 and 2 of this group for the best compromise of harmonics, residual subcarrier, and straight vectors.

Return the 1482 to 10 μs/Div Display rate, A Input, and Volts Full Scale Var in detent.

4. Check/Adjust Burst Phase

a. Set the modulated 12.5T pulse vector to the −U axis (180°) with the vectorscope Ch A Phase control. Set the 522A Display switch to +V.

CHECK— +V burst lines up on the graticule marking at 135° within 1°.

ADJUST—L8150 (see Fig. 4-12) for exactly 135° phasing of the +V burst.

b. Set the 522A Display switch to −V.

CHECK— −V burst vector lines up on the graticule marking at 225° within 1°.

ADJUST—L8140 (see Fig. 4-12) for exactly 225° phasing of the −V burst.

c. Set the 522A Display to Both.

CHECK—Phase difference between the two bursts is 90° within 1°.

GROUP 5—CHROMINANCE

1. Check/Adjust Chrominance Amplifier

a. Set the 1482 to 0.2 Volt Full Scale. To verify the scale factor, display a 30% PEAK WHITE signal (210 mV) and adjust the 1482 front-panel Gain control for 10.5 major divisions (0 V to 1.05 V graticule lines).

b. Position the blanking level to the 0.25 V graticule line.

CHECK—Burst peak is on the 1.0 V graticule line within 2.25 minor divisions (150 mV peak, 300 mV peak-to-peak within 3%). Midrange R8431 (Burst Amplitude) for calibration only.

ADJUST—R7661 (Modulation Gain, see Fig. 4-12), for burst peak at the 1.0 V graticule line (150 mV peak, 300 mV peak-to-peak).

Set the blanking level to the 1.05 V graticule line.

CHECK—Negative burst peak is at the 0.3 V horizontal reference line within 2.25 minor divisions (−150 mV peak, 300 mV peak-to-peak).

2. Check/Adjust LINEARITY Modulation

a. Set the 148-M FULL FIELD SIG Selector (right) to LINEARITY. Set LINEARITY switches for 100 mV and 5 STEPS. Position the blanking level to the horizontal reference line.

CHECK—Amplitude of peak-to-peak staircase modulation is 5 major divisions within 0.5 minor division (100 mV peak-to-peak within 1%).

ADJUST—R3420 (100 mV Mod Amplitude, see Fig. 4-12) for exactly 5 major divisions of peak-to-peak staircase modulation (100 mV peak-to-peak).

b. Set the LINEARITY switches for 140 mV and 5 STEPS. Set the FULL FIELD SIG Selector (right) for FLAT FIELD, and the left selector to LINEARITY. Set the FULL FIELD SIG Mode switch to ALT. Change the VAR APL switch from 10% to 30% PEAK WHITE, noting the relative levels of the APL and the staircase modulation.

CHECK—Relative levels of the APL signal and the staircase modulation are the same within 0.7 minor division (140 mV within 1%).

ADJUST—R3410 (140 mV Mod Amplitude, see Fig. 4-12) for exactly 7 major divisions of staircase modulation (140 mV), check as above.

3. Check/Adjust CCIR-I Staircase Modulation

Set the FULL FIELD SIG Selector (left) switch to CCIR-I. Set the VAR APL switch to 40% PEAK WHITE.

CHECK—The relative amplitudes between the blanking level and 40% PEAK WHITE is the same as the staircase modulation amplitude within 1.4 minor divisions (280 mV within 1%).

ADJUST—R8381 (CCIR-I Chroma, see Fig. 4-12), for equal relative amplitudes.

4. Check/Adjust CCIR-II Modulated Pedestal

a. Set FULL FIELD SIG Selector (left) to CCIR-II. Change VAR APL from 40% to 60% PEAK WHITE, noting the relative amplitudes of the APLs and the first modulation level.

CHECK—Relative levels are equal within 0.7 minor division (140 mV within 1%).

ADJUST—R8272 (Level 1, see Fig. 4-12), for equal relative amplitudes (140 mV).

b. Change the VAR APL from 30% to 70% PEAK WHITE, noting the relative amplitudes of the APLs and the second modulation level.

CHECK—Relative levels are the same within 1.4 minor divisions (280 mV within 1%).

ADJUST—R8171 (Level 2, see Fig. 4-12) for equal relative amplitudes (280 mV).

c. Change the VAR APL from 20% to 80% PEAK WHITE, noting the relative amplitudes of the APLs and the third modulation level.

CHECK—Relative amplitudes are the same within 2.8 minor divisions (560 mV within 1%).

ADJUST—R8172 (Level 3, see Fig. 4-12) for equal relative amplitudes.

5. Check/Adjust Chrominance Risetimes

a. Turn the 145-M U BURST switch Off. Mis-adjust R5920 (3.57 MHz adj, see Fig. 4-13) so that the chrominance free runs fast enough to appear solid.

CHECK—Burst risetime is between 325 ns and 425 ns (375 ns within 50 ns).

ADJUST—L8730 (Burst Envelope, see Fig. 4-12) for best transient response and symmetry of burst, with risetime between 325 ns and 425 ns.

b. Set FULL FIELD SIG Selector (right) to CCIR-II, and Mode switch to ALL LINES.

CHECK—Risetimes of Modulated Pedestal are between 375 ns and 425 ns (400 ns within 25 ns).

ADJUST—L8381 (CCIR-II Mod Envelope, see Fig. 4-12) for best transient response of the modulated pedestal, with risetimes between 375 ns and 425 ns.

6. Check/Adjust MOD PULSE & BAR

a. Set the 148-M to alternate MOD PULSE & BAR with the 100% PEAK WHITE signal. See Fig. 4-14 for the location of adjustments for this step. For calibration only, preset the following controls:

R7615 (Modulation Delay) for symmetrical bottom of pulse and bar modulation.

R8870 (Mod Pulse Chroma Gain) for flat bottom of pulse and bar.

R486 (Sin^2 Pulse Gain) for pulse peak at 100% PEAK WHITE (700 mV).

R482 (Sin^2 Bar Gain) for bar peak at 100% PEAK WHITE (700 mV).

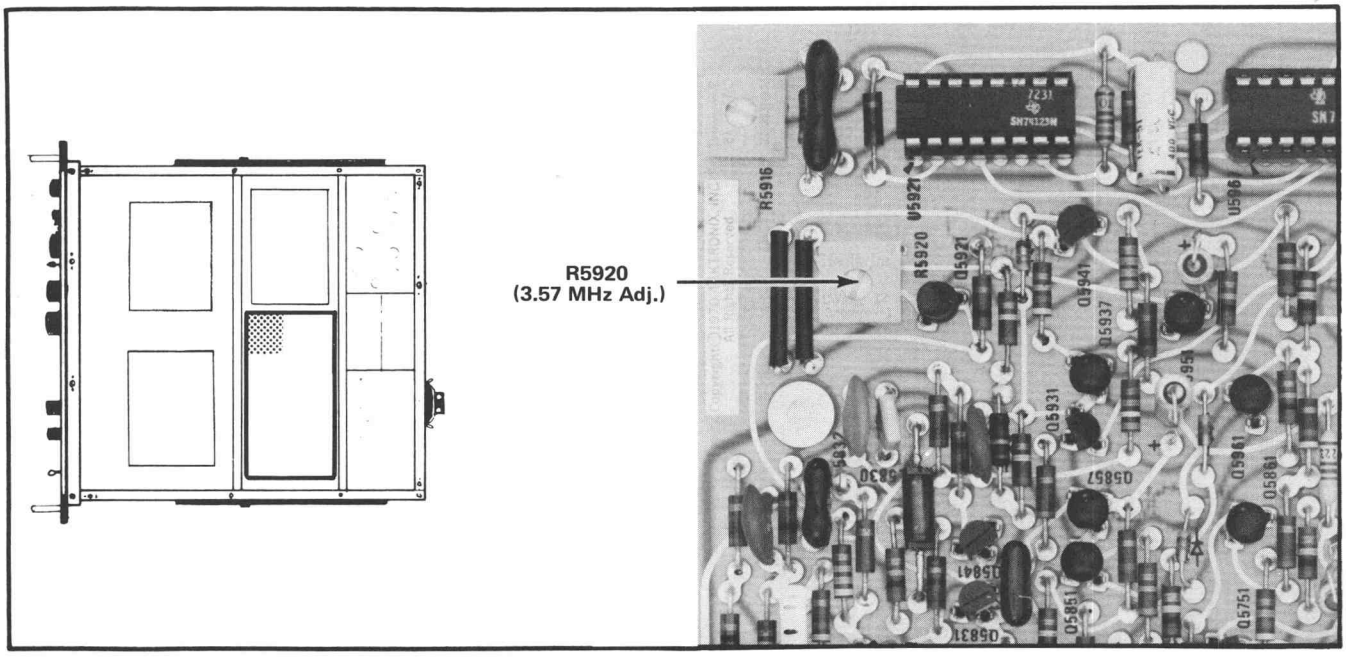

Fig. 4-13. Gen Lock circuit board location of 3.57 MHz frequency adjustment.

b. Set the 1482 Mag to X10. Position the modulated pulse to the center of the graticule.

CHECK—Half Amplitude Duration (HAD) of mod pulse is 1.57 μs within 50 ns, and bar risetime is 1.41 μs within 50 ns.

SELECT—C485 for 1.57 μs HAD within 50 ns.

c. CHECK—Baseline ripple on the bottom of the pulse is 3.5 mV or less.

ADJUST—L415, L435, L455, and L475 (12.5T Filter) for minimum residual subcarrier immediately following the pulse.

ADJUST—R7615 for symmetrical baseline of pulse and bar.

d. CHECK—Amplitude of pulse and bar modulation is from the blanking level to the 100% PEAK WHITE level within 3.5 minor divisions (700 mV within 1%).

ADJUST—R8870 for the chrominance at the bottom of the pulse and bar to end exactly at the blanking level.

ADJUST—R486 for the pulse chrominance to peak at exactly 100% PEAK WHITE (700 mV).

ADJUST—R482 for the bar chrominance to peak at exactly 100% PEAK WHITE (700 mV).

Remove P8490. Set VAR APL to 50%.

CHECK—Luminance components of pulse and bar are 50% PEAK WHITE within 3.5 minor divisions (350 mV within 2%).

Replace P8490. Turn the 145-M U BURST switch ON.

GROUP 6—PULSE AMPLITUDE AND WIDTH

NOTE

See Fig. 4-15 for adjustment and pin connector locations for this group.

1. Check/Adjust 2T PULSE Amplitude and Width

a. Set the FULL FIELD SIG Selector (right) to PULSE & BAR. Set the Mode switch to ALL LINES.

CHECK—2T PULSE amplitude is within 3.5 minor divisions of the BAR amplitude (700 mV within 1%). (Use 1482 Waveform Comparison controls for this measurement.)

b. Set the 1482 for 1.0 Volt Full Scale, Mag to .1 μs/Div. Position the half amplitude point of the 2T PULSE at the horizontal reference graticule line.

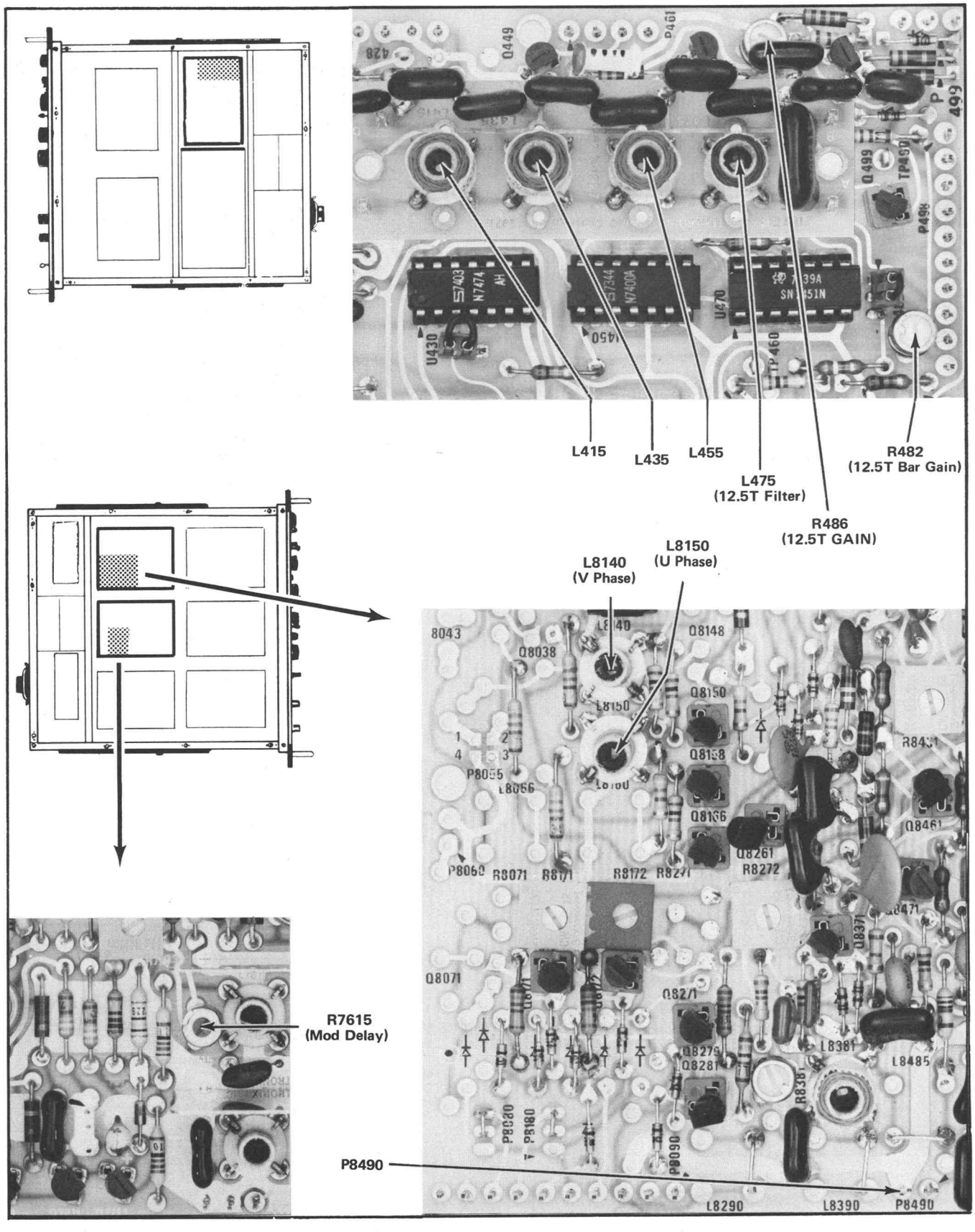

Fig. 4-14. MOD PULSE & BAR adjustments.

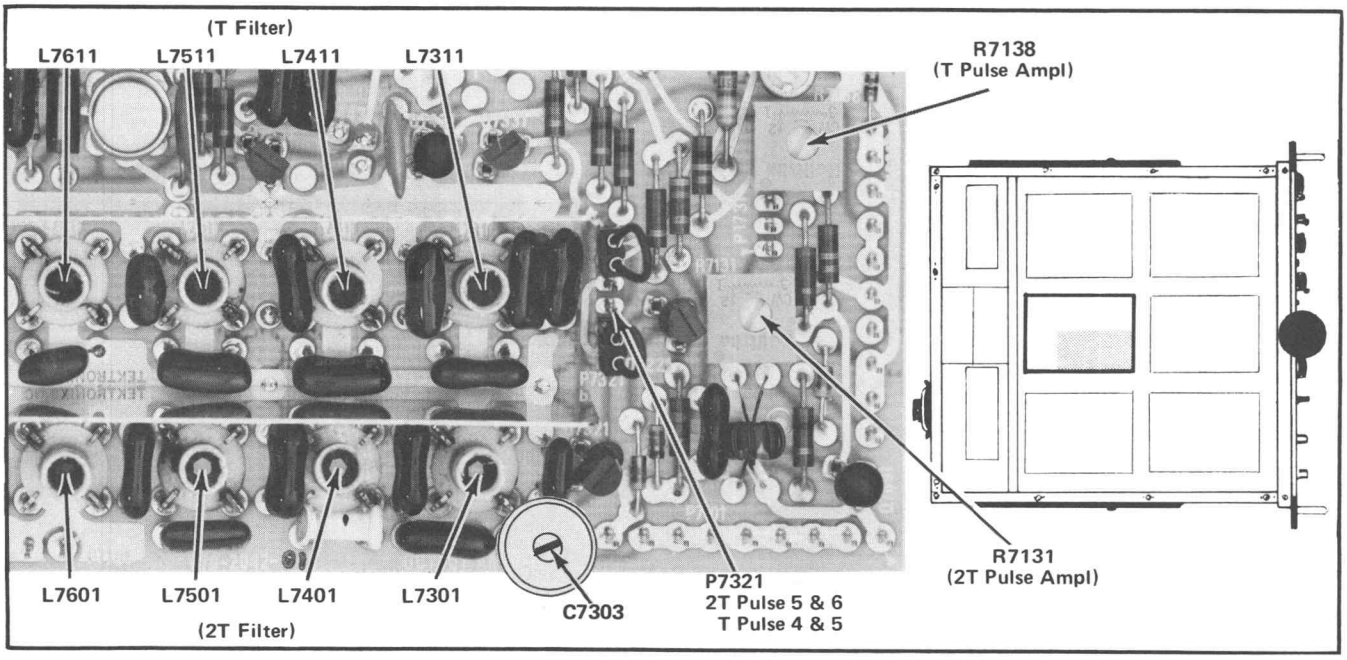

Fig. 4-15. Filter pin connectors and adjustment locations.

CHECK—Half Amplitude Duration is between 212 ns and 288 ns (250 ns within 15%).

Set the 1482 to 0.2 Volt Full Scale.

CHECK—Ringing after the pulse is 1.75 minor divisions or less (0.5% or less).

ADJUST—L7301, L7401, L7501, L7601, and C7303 for a Half Amplitude Duration of 250 ns within 15%, ringing of 0.5% or less, and symmetrical rise and fall times.

ADJUST—R7131 (2T Pulse Amplitude) to match the BAR amplitude exactly.

2. Check/Adjust T PULSE Amplitude and Width

Change the grey connector on P7131 to pins 2 and 3, and the grey connector on P7321 to pins 4 and 5.

CHECK—T PULSE amplitude is within 1% of BAR amplitude, ringing is 1% or less, and Half Amplitude Duration is 125 ns within 15% (106 ns to 144 ns).

ADJUST—L7311, L7411, L7511, and L7611 for a Half Amplitude Duration of 125 ns within 15%, and ringing of 1% or less.

ADJUST—R7138 (T Pulse Ampl) for the T PULSE amplitude to exactly match the BAR amplitude.

Reconnect the grey connectors for a 2T PULSE (P7131-1 & -2; P7321-5 & -6).

3. Check BAR Risetimes

CHECK—BAR risetime is 115 ns within 15% (98 to 132 ns).

Change the violet connector on P7321 to pins 2 and 3.

CHECK—BAR risetime is 230 ns within 15% (195 ns to 265 ns).

Return the violet connector to P7321-4 & -5 (T BAR).

CHECK—BAR tilt is 0.5% or less (3.5 mV or less) in any 10 μs segment.

GROUP 7—MULTIBURST

NOTE

See Fig. 4-17 for adjustment and test point locations.

1. Check/Adjust Harmonics

Connect the 1401A Spectrum Analyzer as in Group 4 Step 3.

Set the FULL FIELD SIG Selector (right) to CCIR-II. Remove P8490.

CHECK—All Multiburst harmonics are lower amplitudes than −40 dB.

ADJUST—C6693, C6788, R6898, and R6977 (MB Harmonics) for minimum harmonics. (−40 dB attenuation or more.)

Replace P8490.

2. Check/Adjust Multiburst Frequencies

Connect a 10X probe from the test oscilloscope input to TP6301. Use the Delay Time Multiplier on the test oscilloscope to check and adjust the Multiburst frequencies according to the following:

Frequency	Test Scope	CHECK	ADJUST
500 kHz	.5 μs/Div	2 cycles in 8.0 Div ±3%	R6304
1.0 MHz	.2 μs/Div	1 cycle in 5.0 Div ±3%	R6202
2.0 MHz	.2 μs/Div	2 cycles in 5.0 Div ±3%	R6314
3.0 MHz	.1 μs/Div	3 cycles in 10.0 Div ±3%	R6324
3.57 MHz	minimum opening on vectorscope (less than 120°)		R6334
4.2 MHz	.1 μs/Div	3 cycles in 7.14 to 7.28 Div (+0, −2%)	R6344

Remove the 10X probe. Recheck harmonics. The harmonics and frequency adjustments are interactive; if either is adjusted, the other must be checked.

3. Check/Adjust for Whole Cycles

Reset the waveform monitor 5 μs/Div and Var in detent.

CHECK—The 500 kHz packet contains at least two complete cycles, and the remaining packets consist of complete sinewaves starting and stopping at the 350 mV reference level.

ADJUST—R7615 (MB Length) for two complete cycles of 500 kHz and complete cycles of the remaining packets.

4. Check/Adjust Multiburst Flatness

a. Set the MULTIBURST AMPLITUDE switch to 350 mV. Set the 1482 to 0.2 Volt Full Scale (calibrated), 2 Field Display, and X50 Mag.

CHECK—Flat tops and bottoms of Multiburst packets are within 1.75 mV (within 0.5%).

ADJUST—R6736 (MB Bandpass) for symmetrical tops and bottoms, and C7463 (350 mV Flatness) for flat tops and bottoms.

b. Set the MULTIBURST AMPLITUDE switch to 700 mV.

CHECK—Flat tops and bottoms of packets are within 3.5 mV (within 0.5%).

ADJUST—C7461 (700 mV Flatness) for flat tops and bottoms.

Recheck the 350 mV flatness, then leave the MULTIBURST AMPLITUDE switch set to 700 mV.

If the packets are not flat, re-do steps 1 through 3 of this group. Adjust for the best compromise between harmonics and flatness.

5. Check/Adjust Multiburst Average Level

Push the vectorscope Y button.

CHECK—The 4.2 MHz level matches the reference level, see Fig. 4-16.

ADJUST—R6673 (MB Centering) to match the level of the 4.2 MHz burst to the reference level.

6. Check/Adjust Multiburst Sync Level

CHECK—Horizontal and vertical sync levels are the same.

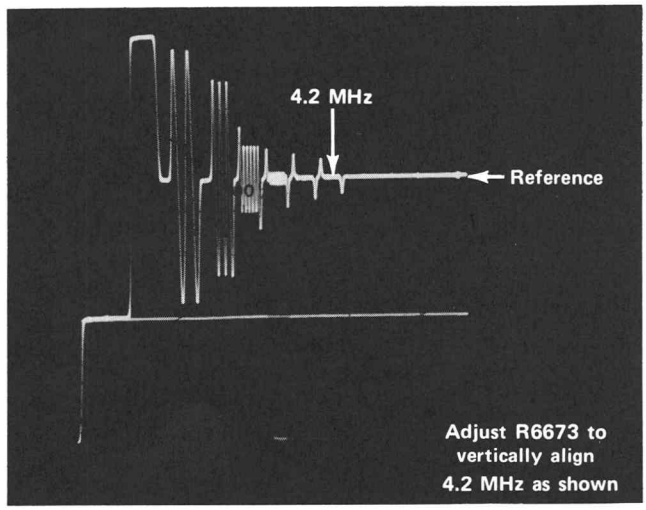

Fig. 4-16. Typical vectorscope display (Y) of Multiburst luminance.

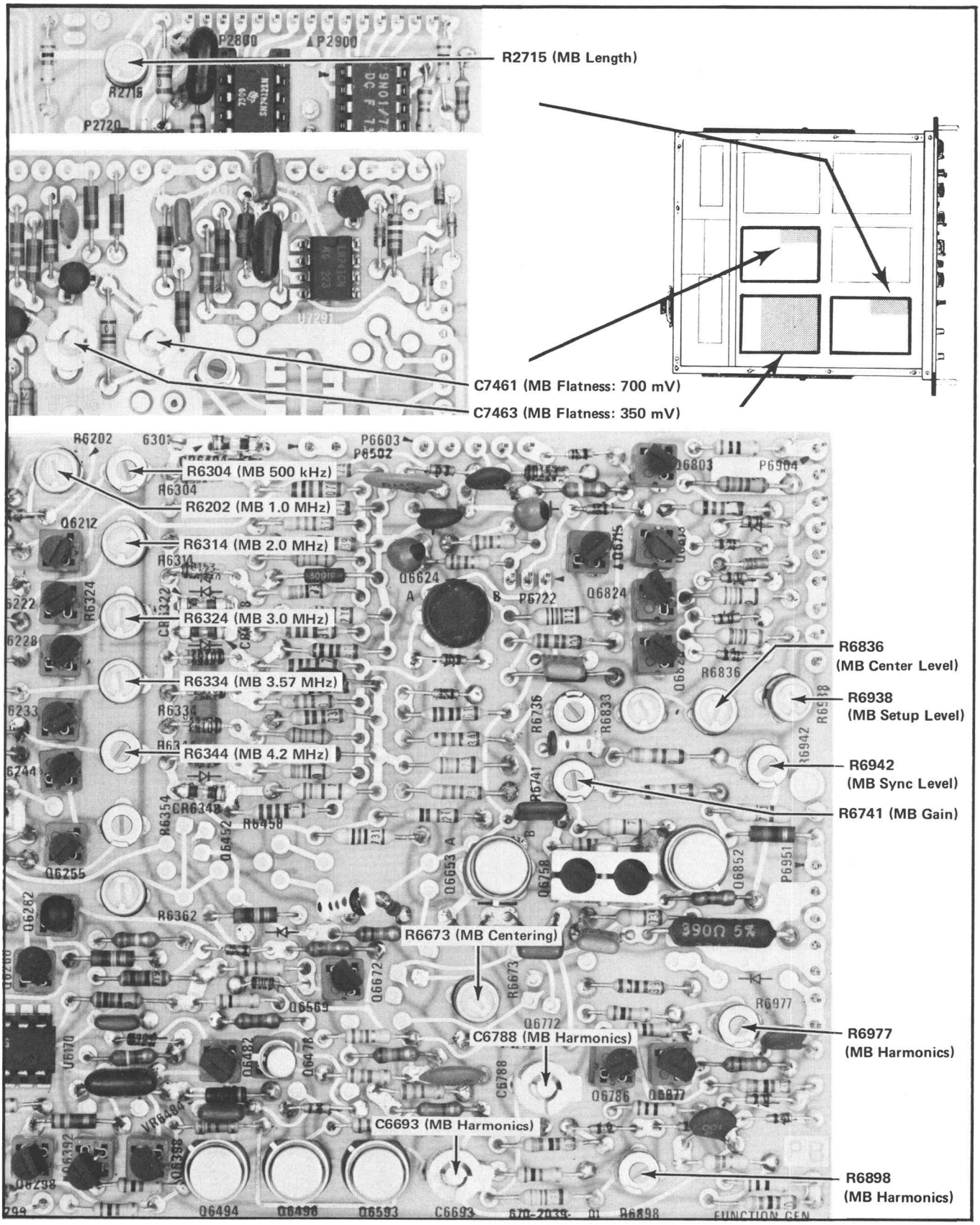

Fig. 4-17. Multiburst adjustment locations.

ADJUST—R6942 (MB Sync Level) to match the horizontal and vertical sync levels.

7. Check/Adjust Multiburst Amplitudes

a. Recheck accuracy of 350 mV pedestal level (R6836) or 350 mV within 5 mV.

CHECK—Amplitude of the 500 kHz packet is from the blanking level to 100% PEAK WHITE within 3.5 minor divisions (700 mV within 1%).

ADJUST—R6741 (MB Gain) for exactly 700 mV, 500 kHz packet.

b. Set the MULTIBURST AMPLITUDE switch to 350 mV.

CHECK—The positive peak of the 500 kHz packet is above the 70% PEAK WHITE level 1.75 major divisions with 1.75 minor divisions, and the negative peak is below the 30% PEAK WHITE level 1.75 major divisions within 1.75 minor divisions (350 mV within 1%).

GROUP 8—FIELD RATE SWEEP GEN

1. Check/Adjust Frequencies

Set the FULL FIELD SIG Selector (Right) to FIELD RATE SWEEP GEN. Set the 1482 to 1.0 Volt Full Scale and 2 Field Display. Push the Var Line Selector button and position the intensified portion of the signal to the first line after the fourth marker with the Line Selector Var control.

Set the 1482 to 10 μs/Div Display and .1 μs/Div Mag.

CHECK—There are 2 complete sinewave cycles in approximately 5 major horizontal divisions (approximately 4 MHz).

ADJUST—R6972 (Field Swp Freq Center), see Fig. 4-18, for two complete cycles in 5 major divisions (4 MHz).

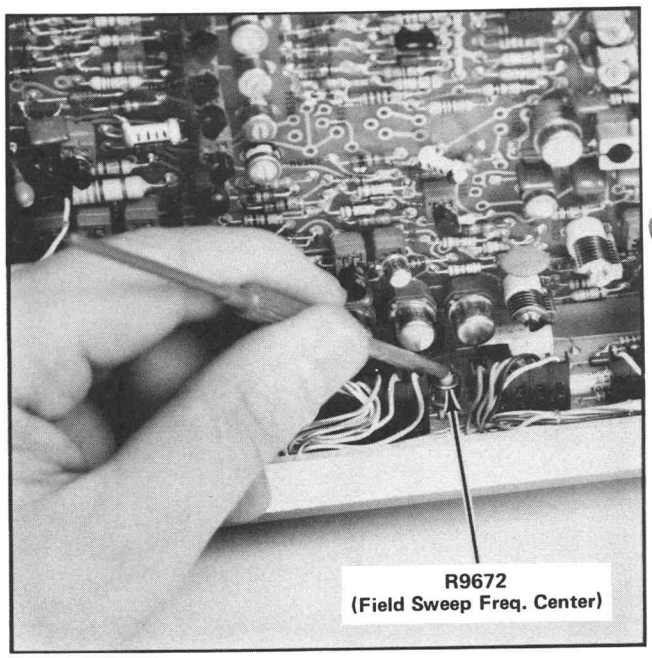

Fig. 4-18. Field Rate Sweep Gen circuit board adjustment location. (CAUTION: Use insulated alignment tool to avoid shorting metal case transistors.)

2. Check Amplitudes

a. Set the 148-M FULL FIELD SIG Mode switch to FULL FIELD SIG & 3 LINES FLAT FIELD: Set the 1482 Mag Off and to 0.2 Volts Full Scale (calibrated).

CHECK—Amplitude of the pedestal matches the 50% PEAK WHITE level within 1.75 minor divisions (350 mV within 1%).

b. Set the 1482 to 2 Field Display.

CHECK—Amplitude of sweep signal is 350 mV peak-to-peak within 1% to 5 MHz (fifth marker). Use test method from Group 7, Step 7b.

c. Set the MULTIBURST AMPLITUDE switch to 700 mV.

CHECK—Amplitude of sweep signal is 700 mV peak-to-peak within 1% to 5 MHz (fifth marker).

GROUP 9—FULL FIELD DIFF GAIN & PHASE

1. Check Diff Gain

Set the FULL FIELD SIG switches to LINEARITY, ALL LINES. Set the vectorscope to measure differential gain.

CHECK—Diff gain is 0.5% or less.

2. Check Diff Phase

Set the vectorscope to measure differential phase.

CHECK—Diff phase is 0.2° or less.

GROUP 10—NOISE

1. Check/Adjust Noise Level Accuracy

a. Set the 1482 Line Selector to Dig, Line 14. Set the NOISE switches for −20 dB of inserted noise. Connect (in listed order) from the 148-M NOISE OUT, a 75 Ω coaxial cable, 4.2 MHz Low Pass Filter, 75 Ω Termination, and the RMS Voltmeter.

CHECK—Noise output should be 70 mV rms within 1 dB.

ADJUST—R3260 (Noise Amplitude), see Fig. 4-19, for 70 mV rms.

NOTE

Verification of the NOISE LEVEL switches accuracy requires misadjustment of the noise amplitude.

b. Set R3260 (Noise Amplitude) for a 0 dB reference on the RMS Voltmeter. Use R3270 (Noise Spectrum) if needed.

CHECK—Noise level should be within 1 dB of the front-panel indication.

ADJUST—R3260 (and R3270) for 70 mV rms.

2. Check Half-Line Insertion

Display the PREVIEW OUTPUT signal on the monitor. Set the INSERTION SIGNAL CONTROL switch to PREVIEW.

CHECK—Half-line of noise should be displayed in the middle of the line (NOISE INSERTION) or a full-line of noise pedestal (NOISE DELETION).

3. Check/Adjust Noise Match

a. Connect the video signal source Composite Sync, Burst Flag, PAL Pulse, and Subcarrier to the 148-M respective inputs. Set the SYNC switch to EXT.

b. Connect the NOISE OUT signal to the PROGRAM INPUT. Set the noise pedestal to match the baseline. Insert −20 dB of noise.

CHECK—Noise amplitudes match.

ADJUST—R7561 (Noise Match), see Fig. 4-19, to match the half-line noise amplitude to the PROGRAM LINE noise.

4. Check VARIABLE Pedestal Control

a. Display the FULL FIELD TEST SIGNAL on the monitor. Insert noise, but set the NOISE LEVEL switch to OFF.

CHECK—VAR control range should be from −50 mV to +50 mV (cw) at each pedestal level, except the 50 mV position, which should have range to 14 mV or less.

b. Set the VARIABLE control for minimum amplitude and the PEDESTAL switch to 50 mV.

CHECK—Baseline transients should be 32 mV or less.

5. Check Noise Spectrum

The noise spectrum should be flat to 5 MHz within 6 dB. See Group 4 Step 3 for setup.

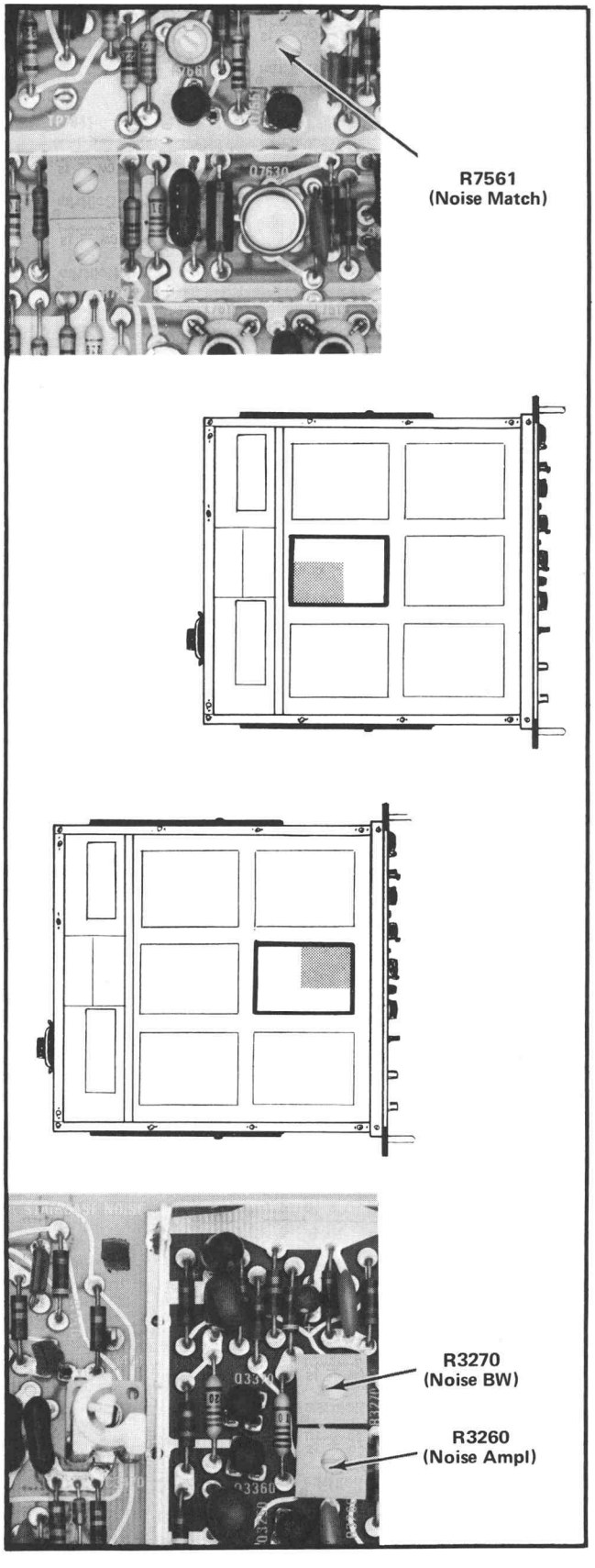

Fig. 4-19. Noise adjustment location.

GROUP 11—GEN LOCK

NOTE

This group of checks requires a video signal source with the ability to shut off its burst and/or sync.

1. Check Light and Output Operation

a. Display the video signal source color bars on the monitor.

CHECK—NOT LOCKED TO PROGRAM light is extinguished and the PROGRAM light should be lit. There should be VITS.

b. Turn off the video signal source sync.

CHECK—NOT LOCKED (red) light is lit; the PROGRAM lamp should be lit. There should be no 148-M VITS. There should be no subcarrier or composite sync outputs from the 148-M.

c. Turn the video signal source sync on and the U burst off.

CHECK—PROGRAM light should be lit. There should be VITS. There should be composite sync output, but no subcarrier output.

d. Turn the video signal source U burst on.

CHECK—There should be a subcarrier output.

3. Disconnect the video signal source.

CHECK—Loss of 148-M VITS and that the 148-M Full-Field signal is on PROGRAM OUT LINE signal, in PROGRAM mode.

CHECK—Burst is present on the Full-Field signal.

2. Check INT/EXT SYNC Mode

a. Connect appropriate 2 V signals from the video signal source to the COMP SYNC, BURST FLAG, PAL PULSE, and SUBCARRIER INPUTS.

CHECK—TP5698, see Fig. 4-20, for 2 pulses, matching in time and width, but with an amplitude ratio of about 5:6.

b. Set the SYNC switch to EXT.

CHECK—TP5698 for 2 pulses with some similarity to the pulses in INT mode.

ADJUST—L9710 (135° Phase) for maximum pulse amplitude; C9719 (225° Phase) to match pulse amplitude and L9772 (Subc Peaking) for flat pulse tops and similarity to the pulses in INT mode.

NOTE

The adjustments for this step are on the small circuit board just forward of the external sync input connectors.

c. Remove, then reconnect, the input signals one at a time.

CHECK—Removal of any of the 4 external sync signals will remove the pulses from TP5698.

d. Leave all external signals connected and set the SYNC switch in EXT.

3. Check Sync Stripper Operation

a. Connect a 10X probe to TP5282.

CHECK—Composite sync amplitude should be between 0.8 and 1.2 V.

b. Connect the probe to plug P5970, pins 2, 3, or 4.

CHECK—Composite sync amplitude should be between 5.0 and 6.0 V.

c. Set the SYNC switch to INT.

CHECK—	
P5970	comp sync 5.0 to 6.0 V
TP5282	comp sync 0.8 to 1.2 V

4. Check Chroma AGC Ratio

NOTE

R5920 (3.57 MHz Adj) is adjusted to make the chroma change easier to see. If it is adjusted, reset it using Step 5.

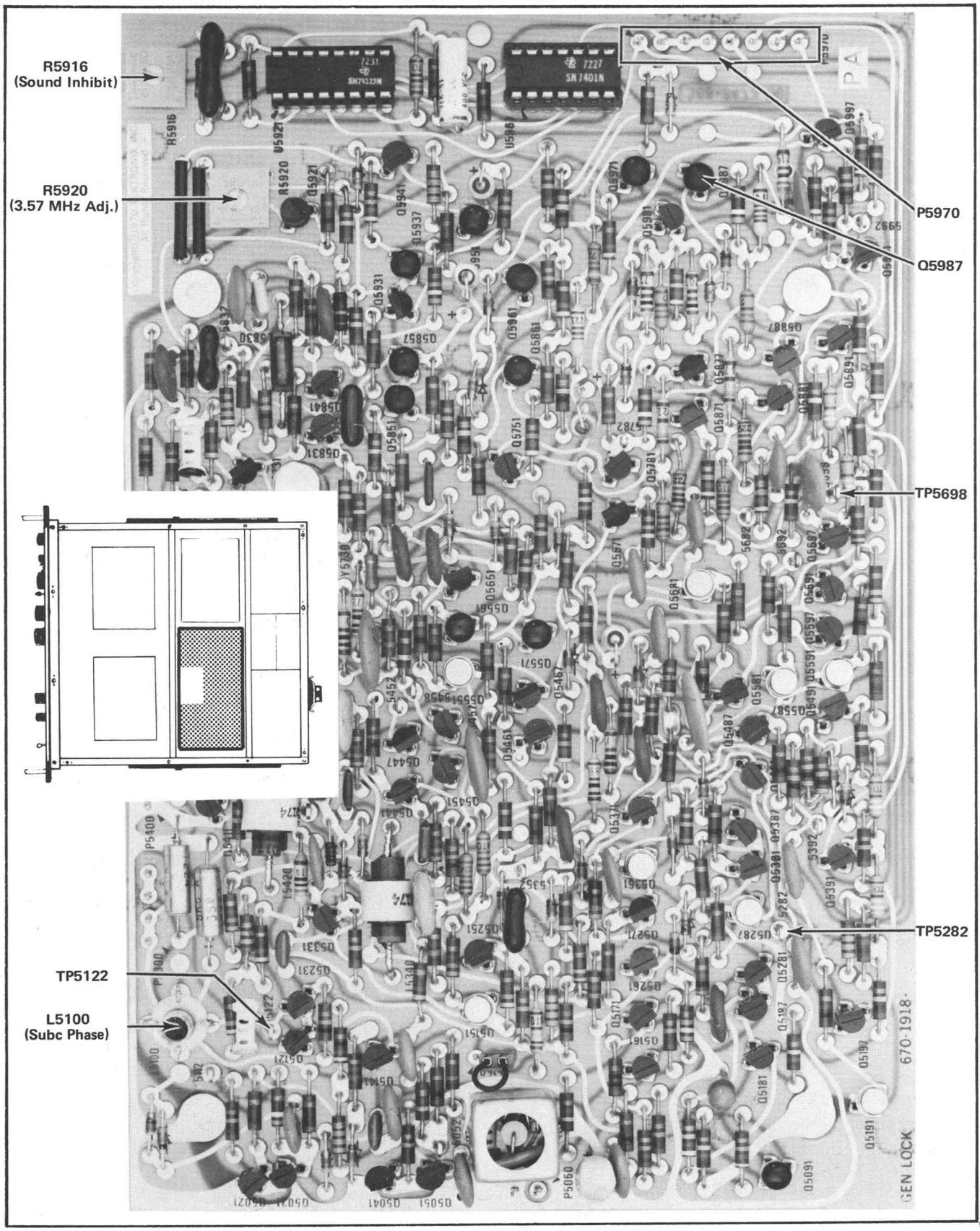

Fig. 4-20. Gen Lock test point, pin connector, and adjustment.

a. Connect a 10X probe to TP5332. Remove Q5987 and adjust R5920 for a chroma variation of about once a second.

CHECK—Burst amplitude ratio should not vary more than 1:1.6.

b. Replace Q5987.

5. Adjust 3.57 MHz Frequency

a. Monitor the Full-Field signal on the vectorscope. Turn the video signal source U burst off.

ADJUST—R5920 (3.57 MHz Adj) for minimum vector rotation. 3.57561149 MHz ±25 Hz.

b. Turn the video signal source U burst on.

6. Check/Adjust Sound Inhibit

Connect a 10X probe to P5970, pins 2, 3, or 4. Display the trailing edge of sync on the test oscilloscope.

CHECK—Sound Inhibit pulse for a trailing edge 275 ns (250 to 300 ns) before the trailing edge of sync.

NOTE

This is a very low writing rate display. If the Sound Inhibit pulse trailing edge cannot be seen, display the signal at U5967B, pin 6, on the test oscilloscope and note its position. Move the probe to U5967B, pin 5, and check for 275 ns between the two signals.

ADJUST—R5916 (Sound Inhibit) for a trailing edge of 275 ns before the trailing edge of sync.

GROUP 12—VITS INSERTION, DIFF PHASE AND DIFF GAIN

1. Check/Adjust PROGRAM LINE OUT

a. Set the video signal source for a full-field modulated staircase test signal. Display the PROGRAM OUTPUT LINE signal on the monitor and vectorscope.

b. Set the vectorscope to measure differential phase.

CHECK—Diff Phase should be 0.15° or less.

c. Set the vectorscope to measure differential gain.

CHECK—Diff Gain should be 0.2% or less.

d. Set the VAR LEVEL to max. Repeat the checks in 1b and 1c except:

CHECK—Diff Phase should be 0.3° or less.

CHECK—Diff Gain should be 0.4% or less.

Set VAR LEVEL controls for unity gain.

2. Check PREVIEW OUTPUTS

Display the PREVIEW OUT signal on the monitor. Repeat the checks in Step 1b and c except:

CHECK—Diff Gain should be 0.4% or less.

CHECK—Diff Phase should be 0.3° or less.

3. Check Programming

a. Display the PROGRAM LINE OUT SIGNAL on the monitor.

CHECK—VITS exist as indicated in Table 4-3 VITS and FF LOGIC.

b. Using Table 4-3 as a guide, check that all internal connectors (as factory connected) are in the appropriate position.

TABLE 4-3

Factory Connected Internal Changes

Board Pin No.	Plug	Pins Nos.	Function
SUBC & SYNC			
P430	Violet	2 & 3 (Outbd)	Alt & 6 Lines Flat Field
P482	Red	1 & 2 (Outbd)	FF Burst-Insert
GEN LOCK			
P5150	Blue	2 & 3 (Fwd)	Subc Lock-CW
OUTPUT			
P7131	Gray	1 & 2 (Outbd)	2T Pulse
P7321	Violet	1 & 2 (Inbd)	T Bar
P7321	Gray	5 & 6 (Outbd)	2T Pulse
VITS & FF LOGIC			
CCIR-I	Brown Diode	F1, F3	
	Brown	17,280	
SIG-III	Red Diode	F1, F3	
	Red	16,279	
CCIR-II	Orange Diode	F2, F4	
	Orange	17,280	
MOD PULSE & BAR	Yellow Diode	F2, F4	
	Yellow	16,279	
EXT, LIN, or P & B	Green Diode	Both	
	Green Diode	15,278	
NOISE	Blue Diode	Both	
	Blue	14,277	
EXT, LIN, P & B P4060	Green	2 & 3 (Inbd)	LINEARITY

GROUP 13—VITS INSERTION

NOTE

The adjustments and checks in this group, except Step 1, require that any errors in the full-field signal be noted or adjusted out.

Display the vertical interval of the rear-panel FULL FIELD TEST SIGNAL on the monitor. If the back proch of the CCIR-II and Pulse & Bar signals are not superimposed with the blanking level they will show up as unwanted VITS pedestal error (Steps 2b and 3b).

Small errors may be adjusted out without further recalibration. Adjust R6942 (MB Sync Level), see Fig. 4-17; adjust R7453 (P & B Sync Level), see Fig. 4-22.

The full-field signal output dc level should be close to 0 V. Adjust R7733 (DC Level), see Fig. 4-10.

All adjustments, except step 1, are shown in Fig. 4-21.

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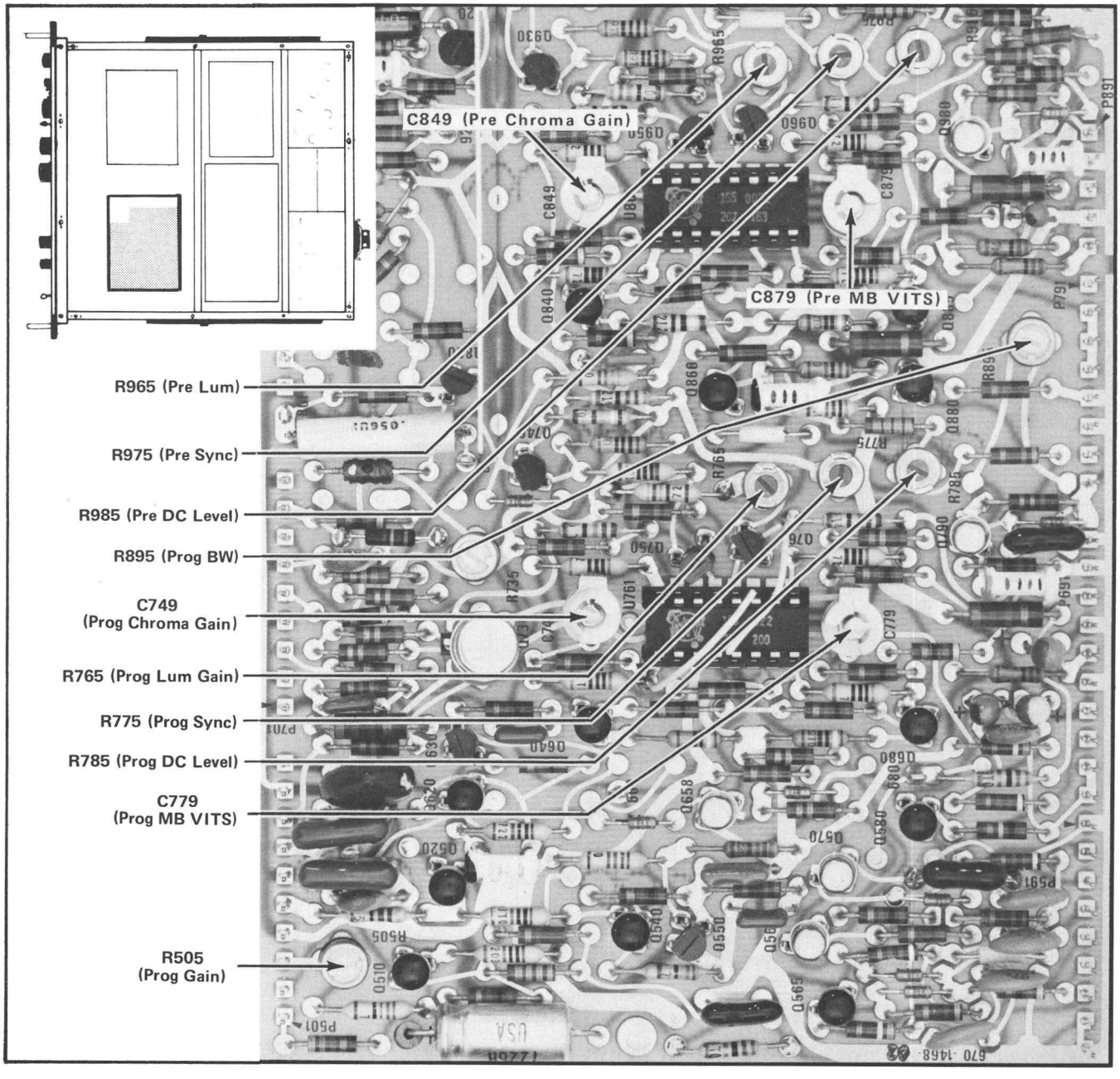

Fig. 4-21. VITS Insertion adjustment.

1. Check/Adjust Auxiliary Sync Level

Display the vertical interval of the PREVIEW OUT signal on the monitor.

CHECK—Display should be similar to the display shown in Fig. 4-22.

ADJUST—R7361 (Aux Sync Level), see Fig. 4-22, to match the levels as shown in Fig. 4-23.

2. Check/Adjust PROGRAM OUTPUT LINE

a. Display the vertical interval of the PROGRAM OUTPUT LINE signal on the monitor. Connect appropriate signals from the video signal source to the COMP SYNC, BURST FLAG, PAL PULSE, and SUBCARRIER INPUTS. Connect a cable from the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM INPUT.

b. Set the FULL FIELD SIG switch to FLAT FIELD and the APL switches to 100. (Set sync switch to EXT.)

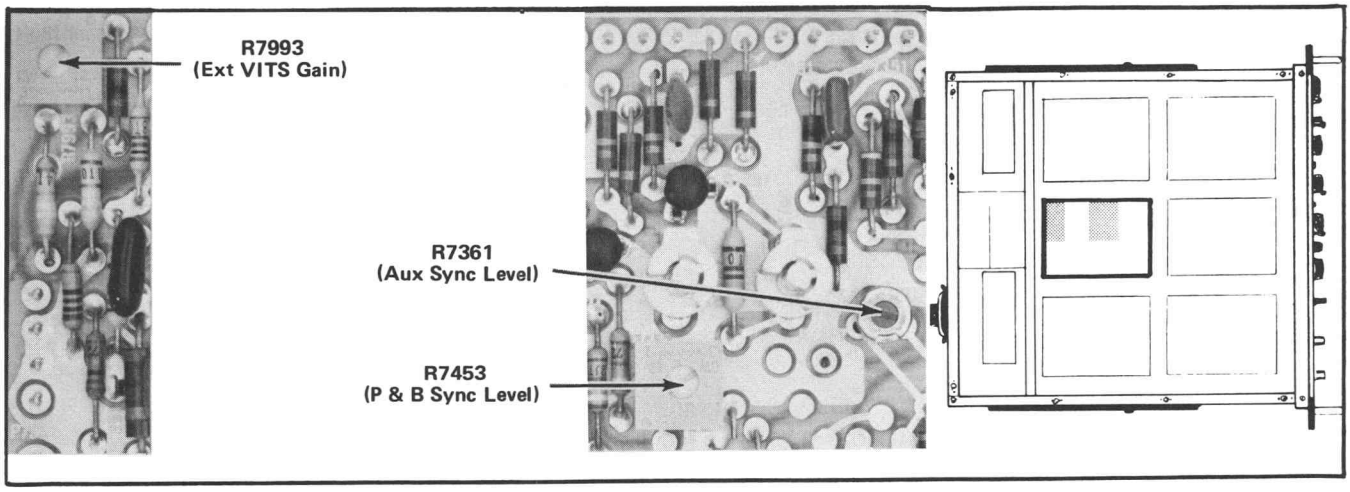

Fig. 4-22. Auxiliary Sync level and external VITS gain adjustment location.

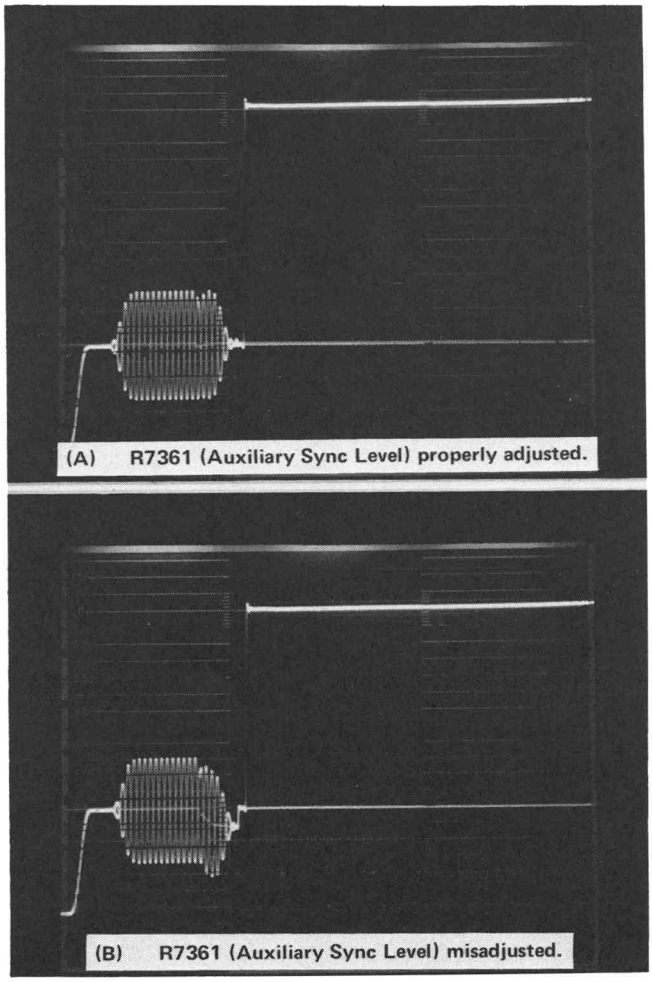

Fig. 4-23. Typical waveform monitor display used to check or adjust auxiliary sync level.

CHECK—VITS blanking level (unwanted VITS pedestal) should be within 5 mV of the blanking level for the non-inserted lines.

ADJUST—R775 (Prog Sync Level) to match the blanking levels.

CHECK—Blanking level (dc) should not change more than 50 mV when switching the INSERTION CONTROL between PROGRAM and BYPASS.

ADJUST—R785 (Prog DC Level) so that no blanking level (dc) change occurs when switching between PROGRAM and BYPASS.

NOTE

The blanking level seen in the BYPASS mode is not necessarily 0 volt, but rather the blanking level of the full-field signal.

c. Switch the INSERTION CONTROL between PROGRAM, PREVIEW, and BYPASS.

CHECK—Blanking level (dc) of the display should not change between any mode. In addition, there should be no amplitude change of the VITS or full-field signals when switching between PROGRAM, PREVIEW, and BYPASS.

ADJUST—R505 (Prog Gain) so that no amplitude change of the insertion signal occurs while switching between PROGRAM and AUXILIARY.

ADJUST—R765 (Prog Lum Gain) so that no amplitude change of the full-field signal occurs while switching between PROGRAM and BYPASS.

d. Step b and c interact; repeat as necessary.

e. Set the FULL FIELD SIG switch to SIG-III. Switch the INSERTION CONTROL between BYPASS and PROGRAM.

CHECK—2T Pulse to Bar; 100% within 0.25% (1.8 mV).

12.5T Pulse to Bar; 100% within 0.5% (3.5 mV).

12.5T baseline ripple; should be 0.5% or less (3.5 mV).

3. Check/Adjust PREVIEW MONITOR OUT

a. Note the dc level of the PROGRAM OUTPUT LINE blanking level.

b. Display the PREVIEW OUTPUT signal on the test oscilloscope. Set the INSERTION CONTROL switch to PREVIEW.

CHECK—Preview blanking level (dc) should be within 50 mV of the level noted in part a.

ADJUST—R975 (Pre Sync Level) so that the VITS blanking level matches the preview blanking level.

ADJUST—R985 (Pre DC Level) so that the preview blanking level matches the program blanking level. (0 volt plus any full-field blanking level error.)

c. Change the cable to display the PROGRAM OUTPUT LINE signal on the test oscilloscope. Note the overall amplitude of the signal. Change the cable to display the PREVIEW OUTPUT signal.

CHECK—Preview signal overall amplitude should match the program signal overall amplitude within 1%.

ADJUST—R965 (Pre Gain) to match the preview signal to the program signal.

d. Steps b and c interact; repeat as necessary.

e. Change the cable to display the other PREVIEW OUTPUT signal.

CHECK—Preview signals should be the same amplitude.

4. Check Multiburst Flatness

a. Set the FULL FIELD SIG switch to CCIR-II. Switch the INSERTION CONTROL between PREVIEW and BYPASS.

CHECK—Tilt on preview multiburst signal (as measured between the first and last burst packets) should match the tilt of the full-field multiburst signal within 1%.

Repeat check for the multiburst signal inserted in the vertical interval.

b. Display the PROGRAM SIGNAL on the test oscilloscope. Switch the INSERTION CONTROL between PROGRAM and BYPASS.

CHECK—Tilt on program multiburst signal should match the tilt of the full-field multiburst signal within 1%.

Repeat check for the multiburst signal inserted in the vertical interval.

5. Check INSERT SUBCARRIER PHASE

a. Connect the video signal source to the PROGRAM INPUT. Display the PROGRAM OUTPUT signal on the vectorscope.

CHECK—INSERT SUBCARRIER PHASE control range is approximately 28°; range should be at least 5° on either side of 180°.

b. Set the INSERT SUBCARRIER PHASE control to set the VITS vectors to 180°. Display the PREVIEW signal on the vectorscope.

CHECK—VITS vectors should be at 180° (no phase error).

6. Check/Adjust Multiburst Flatness, Subcarrier Phase, and Pulse to Bar Ratios

NOTE

Adjustments in Step 6 affect the checks made in Step 2e, Steps 4a and 4b, and Steps 5a and 5b. After making the adjustments, repeat these checks.

a. Disconnect the video signal source from the PROGRAM INPUT. Display the PROGRAM signal on the test oscilloscope.

CHECK—TTL transients should be no more than 5 mV peak-to-peak.

NOTE

If the writing rate of the test oscilloscope is not sufficient to display these transients, do not adjust R780 or C779 at this time, but go to step c.

b. Preset C779 (Prog MB VITS) for minimum capacitance.

ADJUST—R780 (Program Bandwidth) for minimum TTL transients.

c. Connect the FULL FIELD TEST SIGNAL to the PROGRAM INPUT. Set the FULL FIELD SIG switch to CCIR-II.

ADJUST—C779 (Prog MB VITS) so that the tilt of the full-field multiburst insertion signals are the same in either the PROGRAM or the BYPASS position of the INSERTION CONTROL switch.

ADJUST—C749 (Program Chroma Gain) so that the tilt of the full-field multiburst VITS are the same in either the PROGRAM or the BYPASS position of the INSERTION CONTROL switch.

d. Set the FULL FIELD SIG switch to SIG-III.

ADJUST—R780 (Program Bandwidth) so that the pulse and bar amplitudes are the same in either the PROGRAM or the BYPASS position of the INSERTION CONTROL switch.

e. Steps c and d interact; repeat as necessary.

f. Check that the following signals are within the listed tolerances as the INSERTION CONTROL is switched between BYPASS and PROGRAM.

CHECK—Program signal to full-field signal as follows:

MB VITS; within 1%

Chroma Gain; within 1%.

2T Pulse to Bar ratio; 100% within 0.25% (1.8 mV).

12.5T Pulse to Bar ratio; 100% within 0.5% (3.5 mV).

12.5T baseline ripple change; 0.5% or less (3.5 mV).

g. Connect the Signal Generator through the 50 Ω to 75 Ω Min Loss Atten to the 148-M PROGRAM INPUT. Display the PROGRAM OUTPUT on the test oscilloscope. Sync the 148-M externally. Set the Signal Generator for 500 mV of 5 MHz as observed with the 148-M in the BYPASS mode.

CHECK—Test Oscilloscope display should not change by more than ±1% to 5 MHz when the 148-M mode is changed to PROGRAM.

7. Check/Adjust INSERT SUBCARRIER PHASE

a. Connect the video signal source to the PROGRAM INPUT. Set the SYNC SOURCE switch to INT. Display the PROGRAM SIGNAL on the vectorscope.

CHECK—INSERT SUBCARRIER PHASE control range is approximately 28°; range is at least 5° on either side of 180°.

ADJUST—L5100 (VITS Phase) so that the INSERT SUBCARRIER PHASE control range is at least 5° on either side of 180°.

b. Rotate the INSERT SUBCARRIER PHASE control to set the VITS vector to 180°.

c. Display the PREVIEW OUTPUT signal on the vectorscope.

CHECK—VITS vector should be at 180°.

ADJUST—C849 (Preview Flatness) to set the VITS vector to 180°.

8. Check/Adjust PREVIEW OUTPUT

a. Set the SYNC SOURCE switch to EXT. Connect the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM LINE IN.

b. Display the PREVIEW OUTPUT signal on the monitor and vectorscope. Set the FULL FIELD SIG switch to CCIR-II.

CHECK—Tilt of the full-field multiburst insertion test signals are within 1% in either the PREVIEW or the BYPASS position of the INSERTION CONTROL switch.

ADJUST—C879 (Pre MB VITS) so that the tilt of the full-field multiburst insertion test signals are within 1% in either the PREVIEW or the BYPASS position of the INSERTION CONTROL switch.

CHECK—Tilt of the full-field multiburst signals are within 1% in either the PREVIEW or the BYPASS position of the INSERTION CONTROL switch.

9. Check/Adjust Unity Gain

a. Display the FULL FIELD TEST SIGNAL OUT on the 1482. Set the FULL FIELD SIG switch to FLAT FIELD and the APL switches to 100.

b. Push the Oper, Cal, and Back Porch buttons. Determine, then note the peak-to-peak amplitude of the FLAT FIELD test signal.

c. Connect the FULL FIELD TEST SIGNAL to the PROGRAM INPUT. Connect the PROGRAM OUTPUT to the 1482.

CHECK—PROGRAM OUTPUT signal amplitude should be within 1% of that noted in part b.

ADJUST—R765 (Prog Lum Gain) so that the PROGRAM OUTPUT signal amplitude is the same as noted in part b.

d. Connect the PREVIEW OUTPUT to the 1482.

CHECK—PREVIEW OUTPUT signal amplitude should be within 1% of that noted in part b.

ADJUST—R965 (Pre Lum Gain) so that the PREVIEW OUTPUT signal amplitude is the same as noted in part b.

10. Check Waveform Tilt, Program, and Preview

a. Connect the front-panel FULL FIELD TEST SIGNAL to the 1482 A Input. Connect the rear-panel FULL FIELD TEST SIGNAL OUT to the 1482 B Input. Set the FULL FIELD SIG switch to PULSE & BAR. Obtain a differential display and note any tilt (low frequency slope) of the 26 μs bar.

b. Connect the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM INPUT. Connect the PROGRAM OUTPUT to the 1482 B Input.

CHECK—Tilt should be within 0.5% of that noted in part a (3.6 mV or less).

c. Connect the PREVIEW OUTPUT to the 1482 B Input.

CHECK—Tilt should be within 0.5% of that noted in part a (3.6 mV or less).

d. Connect the rear-panel FULL FIELD TEST SIGNAL to the 1482 B Input. Set the FULL FIELD SIG switch to FIELD SQ WAVE. Obtain a differential display of the field square-wave signal and note any tilt error.

e. Connect the rear-panel FULL FIELD TEST SIGNAL to the PROGRAM INPUT. Connect the PROGRAM OUTPUT to the 1482 B Input.

CHECK—Tilt change should be within 0.5% (3.6 mV or less).

f. Connect the PREVIEW OUTPUT to the 1482 B Input.

CHECK—Tilt change should be within 0.5% (3.6 mV or less), referenced to the full-field signal.

11. Check AUXILIARY PEDESTAL

a. Display the PREVIEW OUTPUT signal on the monitor. Set the INSERTION CONTROL switch to AUXILIARY.

CHECK—AUXILIARY PEDESTAL control range should be from $\leq$70 mV to $\geq$630 mV.

b. Connect a 0.1 to 0.5 V signal to the AUX IN input (the video signal source subcarrier signal via a X10 attenuator is acceptable).

CHECK—External signal rides on the auxiliary pedestal; it should not affect sync or VITS.

12. Check UNITY GAIN/VAR & LEVEL

Set the INSERTION CONTROL switch to PROGRAM. Set the UNITY GAIN/VAR switch to VAR. Display the PROGRAM OUTPUT signal on the monitor.

CHECK—LEVEL control range should be from 70% (or less) to 140% (or more).

13. Check PROGRAM OUTPUT Aberrations

a. Disconnect the video signal source from the PROGRAM INPUT. Externally sync the 148-M with Burst Flag, PAL Pulse, Subcarrier, and Comp Sync from the video signal source. Connect the PROGRAM OUTPUT to the test oscilloscope.

CHECK—Residual subcarrier, should be −60 dB (0.7 mV) or less, on lines 11 through 16 and lines 20, 21, and 22.

b. Connect a 4.2 MHz Low Pass Filter in series with the PROGRAM OUTPUT signal.

CHECK—All blanking lines and inactive parts of lines. Except for the Insertion Test Signals there should be no signal greater than −40 dB (7.0 mV).

c. CHECK—Active parts of lines for spurious signals, should be no greater than −60 dB (0.7 mV).

d. CHECK—Crosstalk. Rotate the FULL FIELD SIG switch. Signal change (crosstalk) should not exceed:

−70 dB (0.22 mV) for 2T Pulse,

−60 dB (0.7 mV) for subcarrier (CCIR-II),

−60 dB (0.7 mV) for all other Full Field signals.

e. Connect a 4.2 MHz Weighting Network in series with the PROGRAM OUTPUT and the 4.2 MHz Low Pass Filter.

CHECK—Hum and power line related transients, should be no greater than −60 dB (0.7 mV).

f. Connect a 75 Ω termination to the PROGRAM INPUT. Connect the PROGRAM OUTPUT through a 4.2 MHz Weighting Network, 4.2 MHz Low Pass Filter and 75 Ω termination to the RMS Voltmeter.

CHECK—Random noise output, should be no greater than −75 dB (0.14 mV).

g. Connect an external composite video signal which contains a Pulse and Bar inserted between lines 10 and 18 of the vertical interval. Remove the two diode jumpers from the OFF line, ALL FIELD selection jumpers. Add diode jumpers to both field selector rows.

CHECK—Incoming VITS should be deleted as follows:

2T Pulse	−70 dB
Subcarrier	−60 dB

GROUP 14—TIMING

1. Check INSERT DELAY Range

a. Display the FULL FIELD TEST SIGNAL on the 1482. Select a reference point on the signal and vary the INSERT DELAY control.

CHECK—Range of control should be greater than 1 μs.

b. Leave the control at electrical center.

2. Check/Adjust Pulse Width

Observe the sync pulse.

CHECK—Timing accuracy as given below.

Fig. 4-24	Component	Timing
A	serration width	4.3 to 4.7 μs
B	sync width	4.66 to 4.76 μs
C	equalizer width	2.3 to 2.5 μs

ADJUST—Timing accuracy as given below.

Fig. 4-25	Timing
R356 (Serration Width)	4.5 μs
R351 (Sync Width)	4.71 μs
R251 (Equalizer Width)	2.4 μs

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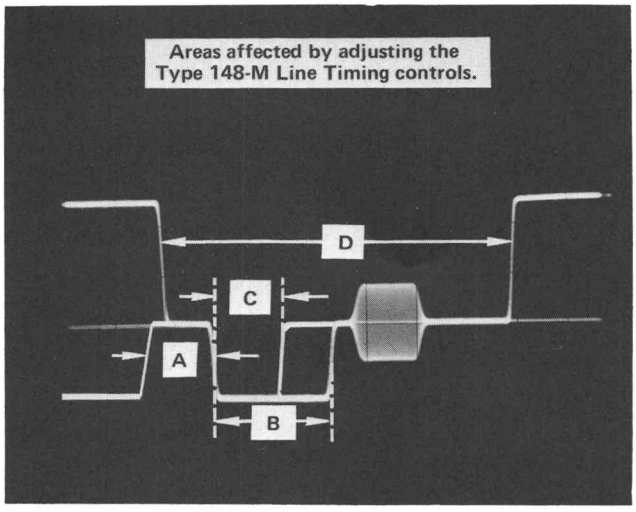


Fig. 4-24. Areas affected by timing adjustments.

3. Check/Adjust Sync Delay

a. Display the vertical interval of the PROGRAM OUTPUT signal on the 1482. INSERT DELAY control should be at electrical center. Observe the sync pulse of the noise, multiburst, or color bar insertion signal.

CHECK—Timing, as shown in Fig. 4-24D, should be 11.1 μs within 0.25 μs.

ADJUST—R1978 (Sync Delay), see Fig. 4-25, for 11.1 μs.

4. Check Bypass Relay

Set the 148-M POWER switch to OFF.

CHECK—Test oscilloscope display should be the video signal source with no VITS inserted.

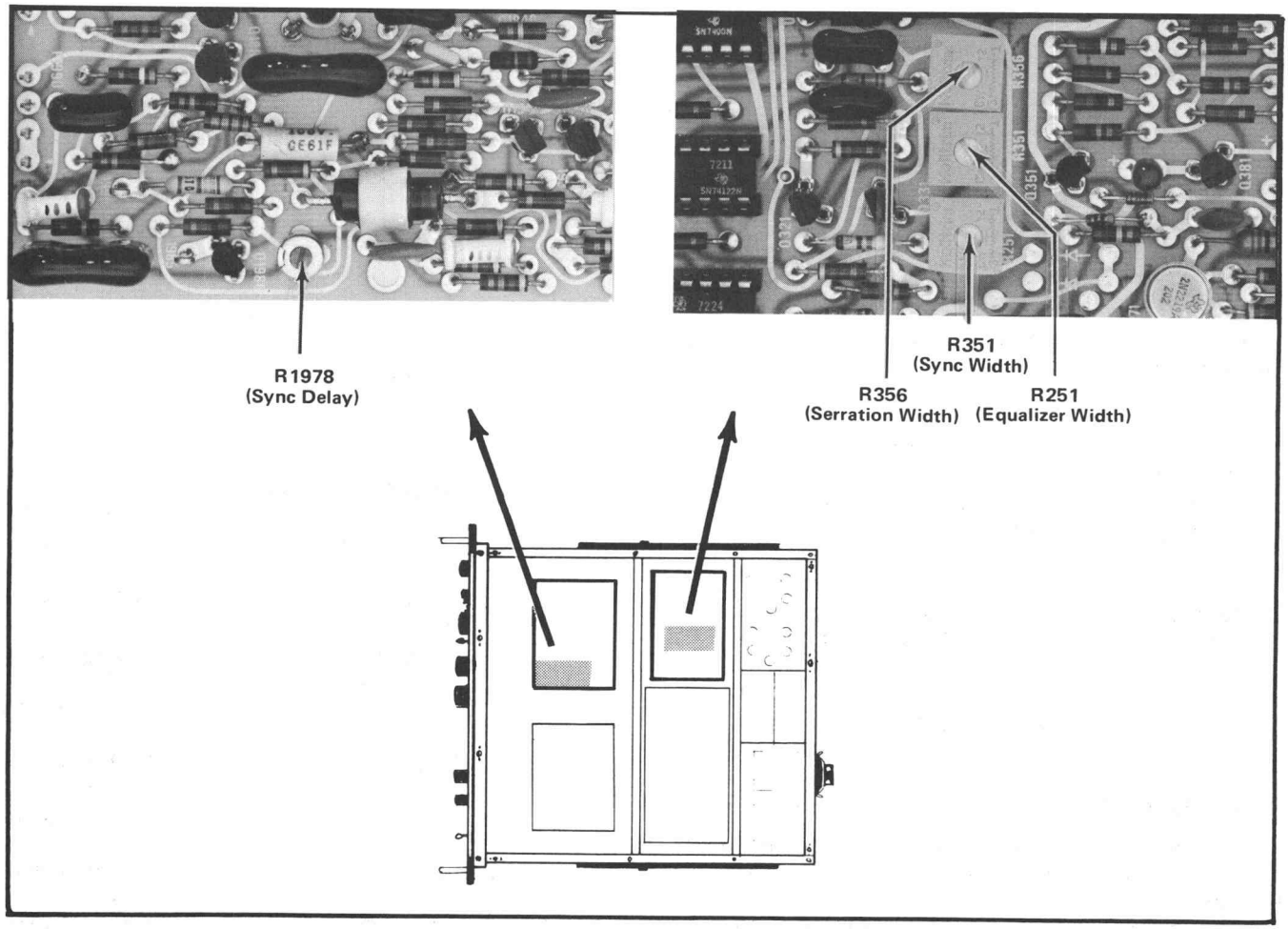


Fig. 4-25. Timing adjustment locations.

5. Check ALT and FULL FIELD SIG & 3 LINES FLAT FIELD Operation

a. Display a field of 148-M FULL FIELD signal, magnified 10 times. Set the Mode switch to ALT.

Display should be the signal selected by the right FULL FIELD SIG switch followed by that selected by the left FULL FIELD SIG switch alternately for the entire field.

b. Set the Mode switch to FULL FIELD SIG & 3 LINES FLAT FIELD.

CHECK—Display should be the signal selected by the right FULL FIELD SIG switch followed by 3 lines of flat field for the entire field.

Return the Mode switch to ALL LINES.

GROUP 15—OPTIONAL CHECKS

This group of checks has been performed at the factory and may not be desired by the user.

1. POWER SUPPLY REGULATION

Requires a variable autotransformer.

Repeat the checks given in GROUP 1, Steps 1 and 2, while varying the autotransformer over the line voltage range listed for the LINE VOLTS selector switch position being used.

2. ERASE

Switch to AUX and verify the video signal source puts VITS on lines 10 through 18, both fields.

Remove the 2 black diode jumpers from the OFF line. Remove all field selection jumpers.

Add a black diode jumper (cathode inboard) to both fields and check for erase on both fields, lines 10 through 18. Check line for signal attenuation in ERASE mode, active line area. Use 4.2 MHz Low Pass Filter.

Move jumper to F2, F4 and check for erase on F2, F4, but not F1, F3. Repeat for F1, F3; but not F2, F4.

Check that OFF does not erase.

3. RETURN LOSS

Requires a return loss bridge, constant amplitude signal generator and a minimum loss attenuator. See Test Equipment Used list, item 15. This is to be used in conjunction with the return loss bridge instruction manual.

a. Connect the sync signal from the video signal source to their respective inputs. Set the SYNC SOURCE switch to EXT. Externally trigger the test oscilloscope from composite sync.

b. Balance the bridge.

c. Check return loss with the POWER switch OFF and the PROGRAM OUTPUT connector terminated with the return loss bridge termination.

CHECK—Return Loss should be at least −30 dB (7.9 mV) from 50 kHz to 5 MHz.

d. Turn the POWER switch ON.

CHECK—Return loss as follows:

PROGRAM OUTPUT LINE	−30 dB to 5 MHz (≤7.9 mV).
PROGRAM MONITOR	−30 dB to 5 MHz (≤7.9 mV)
PREVIEW OUTPUT (both)	−30 dB to 5 MHz (≤7.9 mV)
FULL FIELD OUT (rear)	−34 dB to 5 MHz (≤5 mV)
COMPOSITE SYNC	−30 dB to 3.6 MHz (≤7.9 mV)
EXT VITS INPUT	−30 dB to 5 MHz (≤7.9 mV)
AUX IN	−30 dB to 5 MHz (≤7.9 mV)
NOISE OUT (LEVEL-off)	−30 dB to 5 MHz (≤7.9 mV)
FULL FIELD OUT (front)	−34 dB to 5MHz (≤5 mV)

4. EXT VITS GAIN

Requires the video signal source VITS amplitude be set to the full-field amplitude or the difference between the two noted. The VITS Insertion board must be programmed to insert an external VITS.

Connect the rear-panel FULL FIELD SIGNAL to the PROGRAM INPUT. Connect the video signal source comp video to the EXT VITS IN. Connect the video signal source signals required for external sync to the 148-M. Set the SYNC switch to EXT. Set the signal to insert a modulated staircase VITS on line 15, field 1 and program the 148-M for it (P4060-1 & 2). Display the VITS area of the PROGRAM OUTPUT signal on the monitor.

Adjust R7993 (Ext VITS Gain), see Fig. 4-22, to match the external VITS amplitude to the COLOR BAR VITS amplitude.

Display the PROGRAM OUTPUT signal on the vectorscope. Set the vectorscope to measure differential gain, then differential phase on line 15, field 1 & 3.

Check Ext VITS amplifier diff gain $\leq$0.2%, and diff phase $\leq$0.15°.

SECTION 5
RACKMOUNTING

RACKMOUNTING INSTRUCTIONS

Mounting Methods (Figs. 5-1, 5-2, 5-5 and 5-6)

The instruments will fit most commercial consoles and most 19-inch wide racks whose front and rear rail holes conform to Universal, EIA, RETMA and Western Electric hole spacing.

Fig. 5-1 shows the instrument installed in a cabinet type rack with 1 3/4-inch wide slide-out tracks for a non-tilt installation. The instrument is secured into the rack by means of four captive thumb screws. When the thumb screws on the front panel are loosened, the instrument can be pulled out of the rack like a drawer to its fully extended position (see Fig. 5-2). This position permits many routine maintenance functions to be performed without completely removing the instrument from the rack.

The slide-out tracks easily mount to the cabinet rack front and rear vertical mounting rails if the inside distance between the front and rear rails is within 10 1/2 to 24 1/2 inches. Some means of support (for example, make extensions for the rear mounting brackets) is needed for the rear ends of the slide-out tracks if the tracks are going to be installed in a cabinet rack whose inside dimension between front and rear rails is not the proper distance (10 1/2 inches to 24 1/2 inches).

Instrument Dimension

The last page in this section shows dimensional drawings exclusive of the power cord and cables.

Width—A standard 19-inch rack may be used. The dimension or opening between the front rails must be at least 17 5/8 inches (see Fig. 5-2) for a cabinet rack in which the front lip of the stationary section is mounted behind an untapped front rail as shown in the right-hand illustration of Fig. 5-6. This dimension allows room on each side of the instrument for the slide-out tracks to operate so the instrument can move freely in and out of the rack.

Depth—For proper circulation of cooling air, allow at least 2 inches clearance behind the rear of the instrument and any enclosure on the rack (see dimensional drawing). If it is sometimes necessary or desirable to operate the generator in the fully extended position, use cables that are long enough to reach from the instrument to the location where the signal(s) is to be applied.

Rackmounting in a Cabinet Rack

General Information—The slide-out-tracks for the instrument consists of two assemblies, one for the left side of the instrument and one for the right side. Each assembly consists of three sections as illustrated in Fig. 5-3. The stationary section attaches to the front and rear rails of the rack with inside dimensions as indicated in Fig. 5-2; the chassis section attaches to the instrument and is installed at the factory; the intermediate section fits between the other two sections to allow the instrument to be fully extended out of the rack.

The small hardware components included with the slide-out track assemblies are shown in Fig. 5-4. The hardward shown in Fig. 5-4 is used to mount the slide-out tracks to the rack rails having this compatibility.

(a) Front and rear rail holes must be large enough to allow inserting a 10-32 screw through the rail mounting holes (see Fig. 5-6).

(b) Front rail holes may have already been countersunk prior to this installation.

Because of the compatibility given in (b), there will be some screws left over.

The stationary and intermediate sections for both sides of the rack are shipped as a matched set and should not be separated. The matched sets for both sides including hardware are marked 351-0195-00 on the package. To identify the assemblies, note that the automatic latch and intermediate section stop are located near the top of the matched sets when they are properly mated to the chassis sections as shown in Fig. 5-3.

Mounting Procedure—Use the following procedure to mount both sets. See Fig. 5-5 and 5-6 for installation details.

1. To mount the instrument directly above or below another instrument in the cabinet rack, select the appropriate holes in the front rack rails for the stationary sections using Fig. 5-5 as a guide.

2. Mount the stationary slide-out track sections to the front rack rails using either of these methods:

(a) If the front rails are not countersunk, use the pan head screws and bar nuts to mount the stationary sections similar to the right-hand illustration shown in Fig. 5-6.

(b) If the front rails are countersunk, use the flat head screws and bar nuts to mount the stationary sections as shown in Fig. 5-6 right-hand illustration.

3. Mount the stationary slide-out track sections to the non-tapped rear rails using this method:

Mount the left stationary section with hardware provided as shown in the left-hand or center illustration in Fig. 5-6. Note that the rear mounting bracket can be installed either way so the slide-out tracks will fit a deep or shallow cabinet rack. Use Fig. 5-6 as a guide for mounting the right stationary section. Make sure the stationary sections are horizontally aligned so they are level and parallel with each other.

Adjustments

To adjust the slide-out tracks for smooth operation, proceed as follows:

1. Insert the instrument into the rack as described and as shown in steps 1 through 4 of Fig. 5-7 installation procedure.

2. Adjust the slide-out tracks for proper spacing as shown in Fig. 5-8.

Maintenance

The slide-out tracks require no lubrication. The special dark gray finish on the sliding parts is a permanent lubrication.

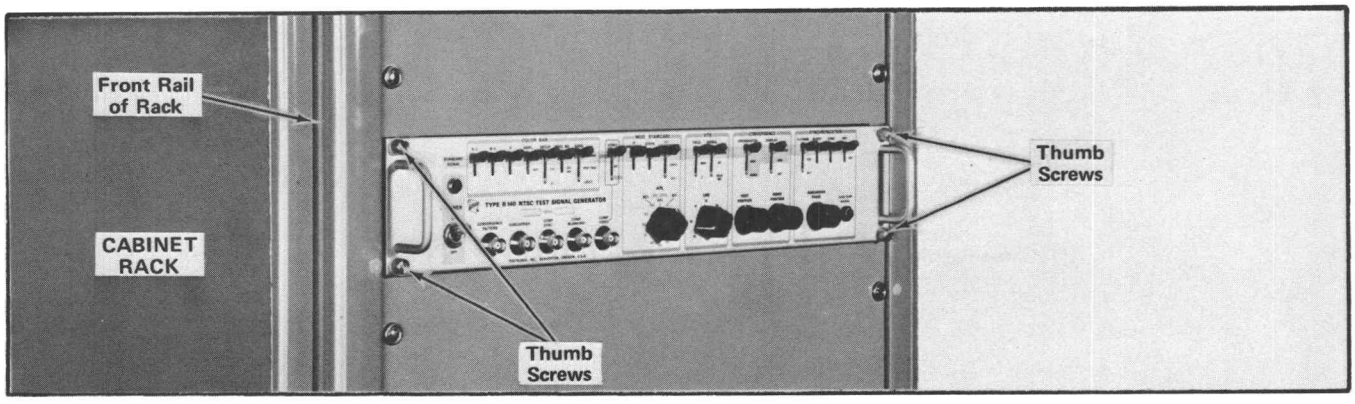


Fig. 5-1. The generator installed in a cabinet rack.

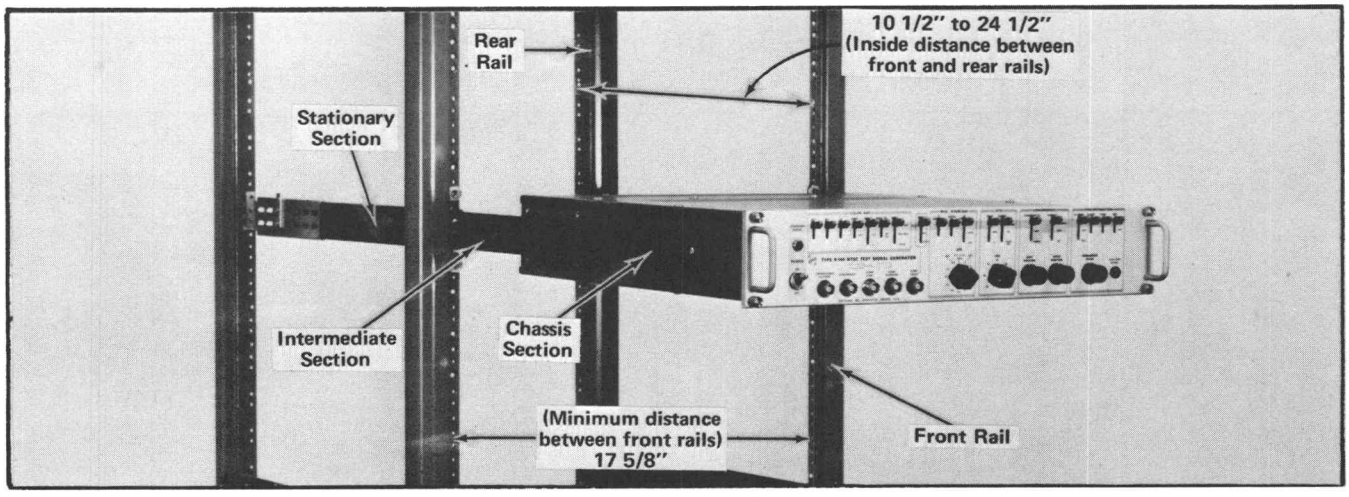


Fig. 5-2. The generator shown in the fully extended position. The cabinet rack sides have been removed from the rack to show mounting.

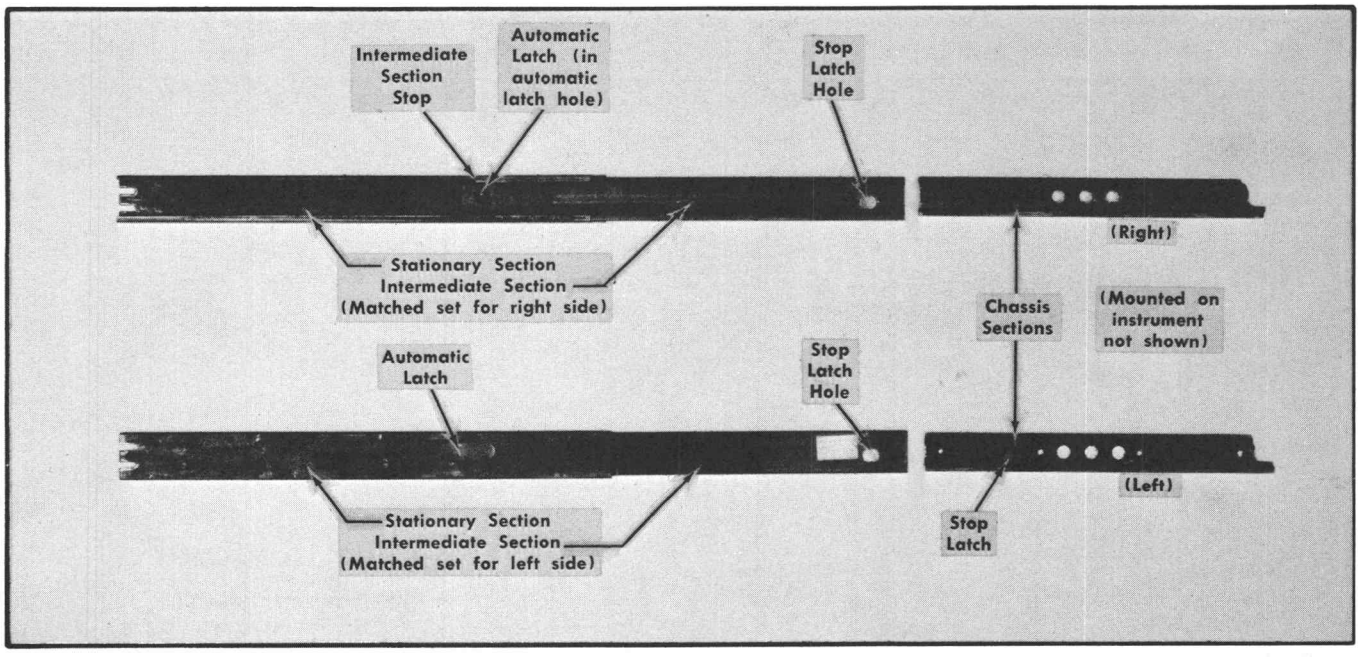


Fig. 5-3. Illustration showing the 1 3/4-inch wide slide-out track assemblies.

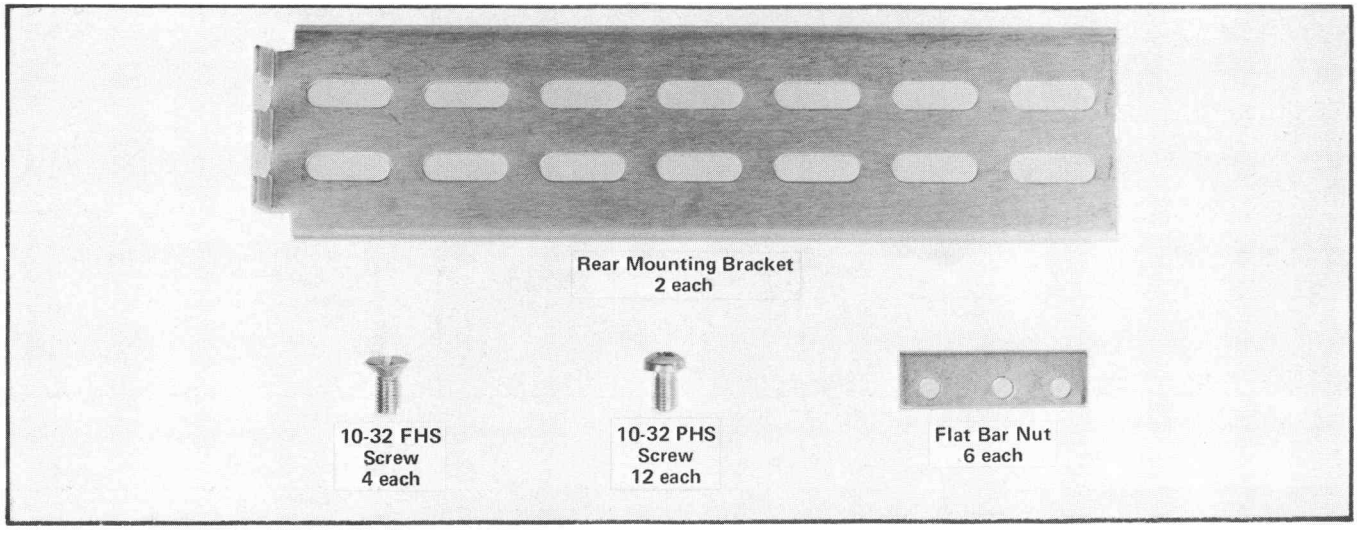


Fig. 5-4. Small hardware components for mounting the stationary sections to the rack rails.

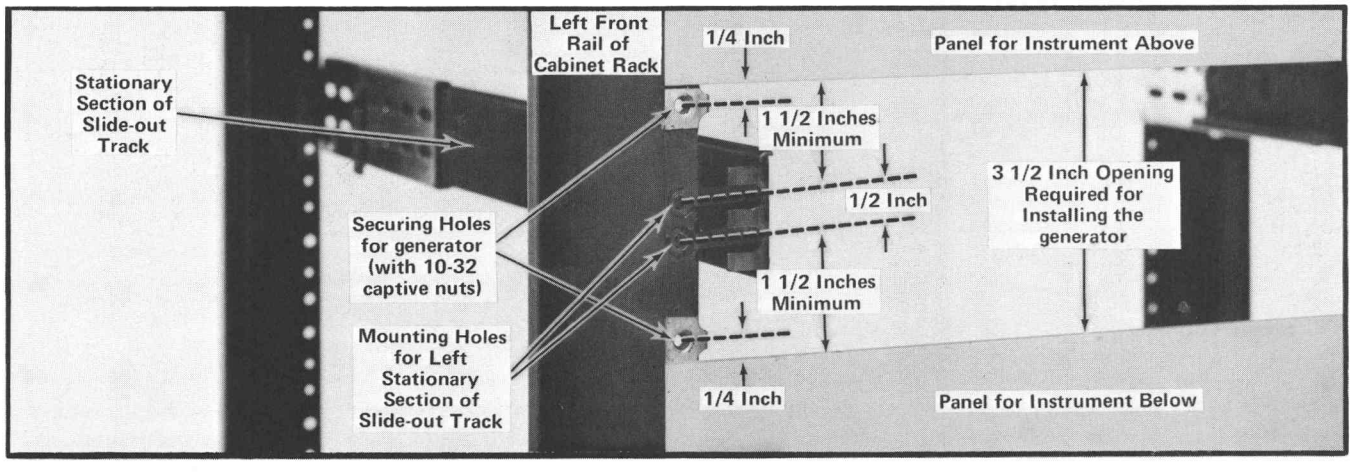


Fig. 5-5. Vertical mounting position of the left stationary section and location of the securing holes. These same dimensions apply to the right front rail.

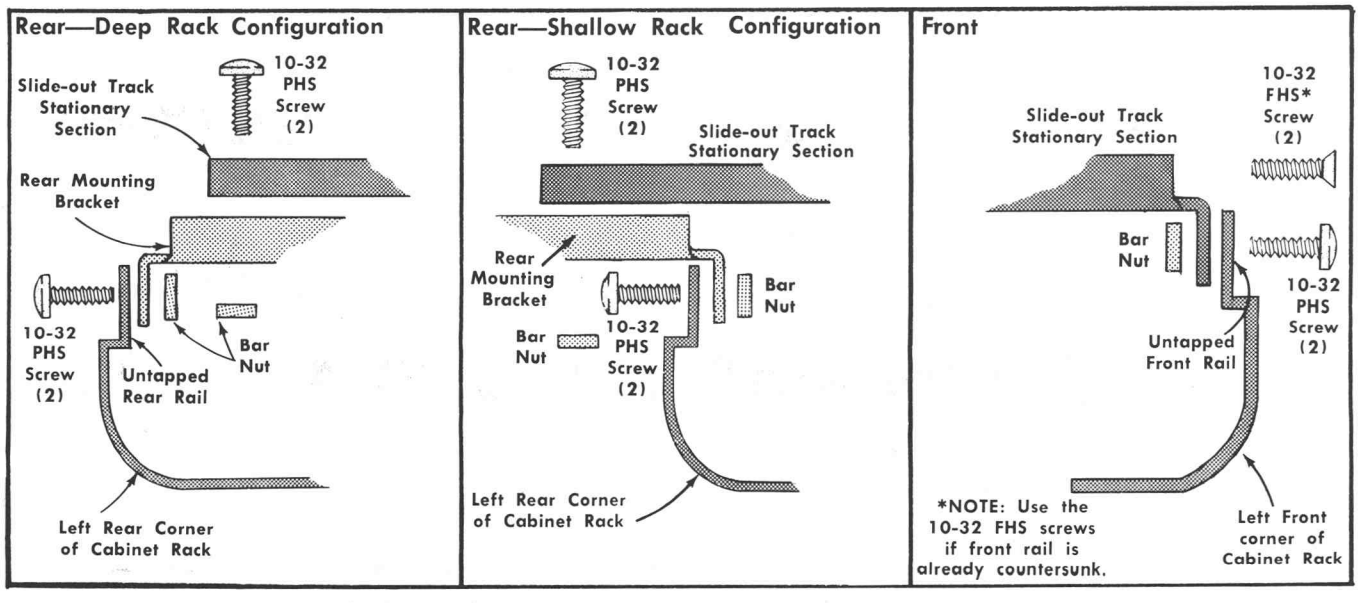


Fig. 5-6. Top view of cabinet rack showing mounting position of the left stationary section to the rails of the rack. Since the rails are not tapped, bar nuts are used to mount the stationary section to the rack rails.

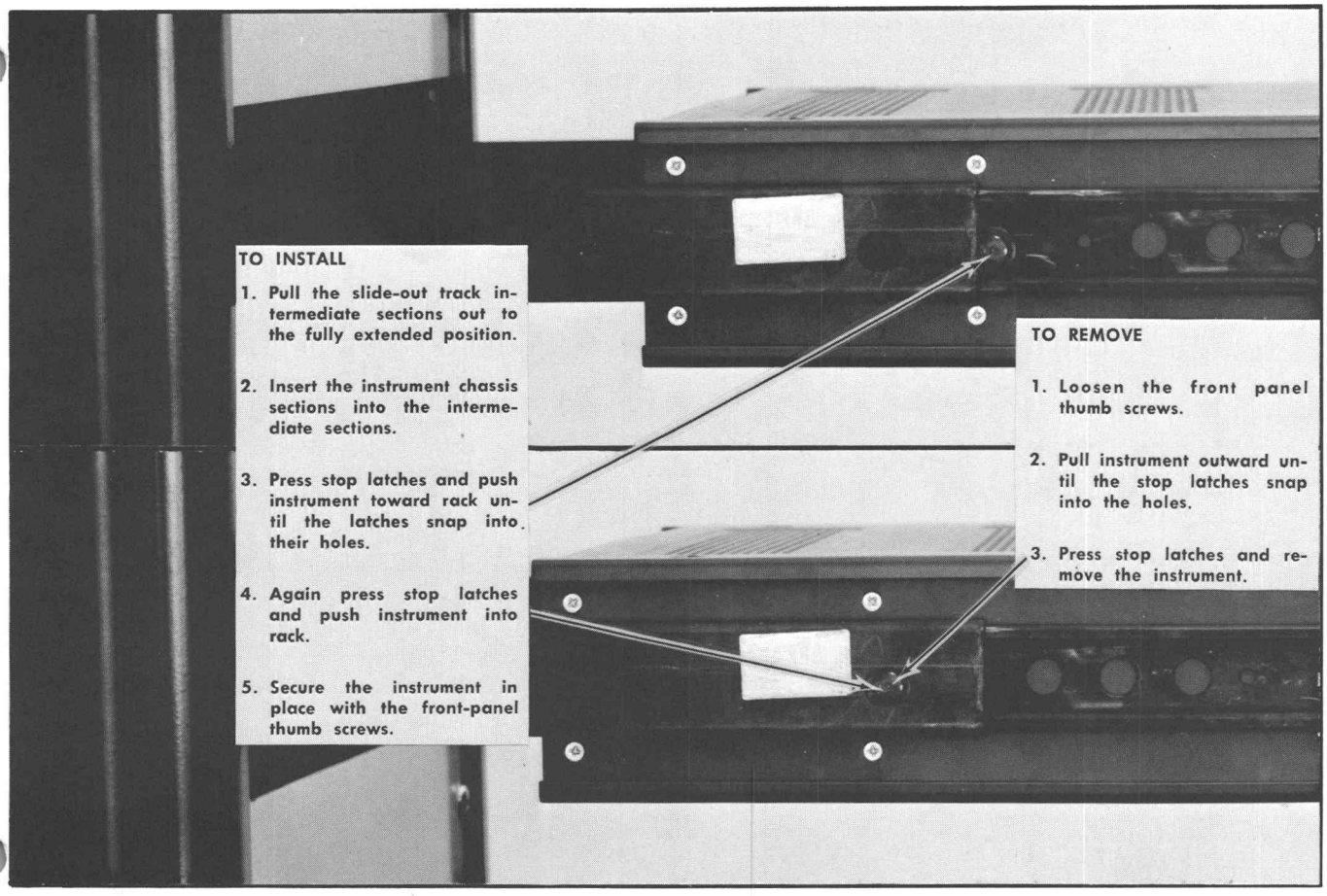


Fig. 5-7. Installing and removing the instrument.

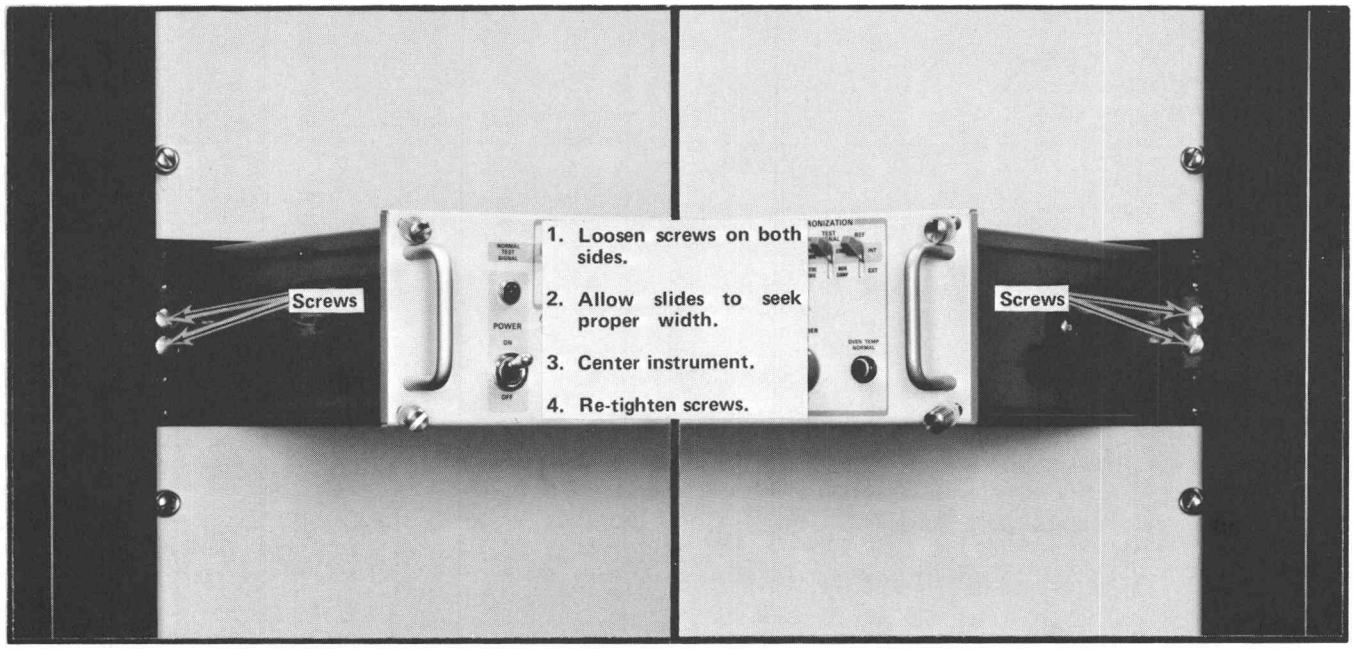
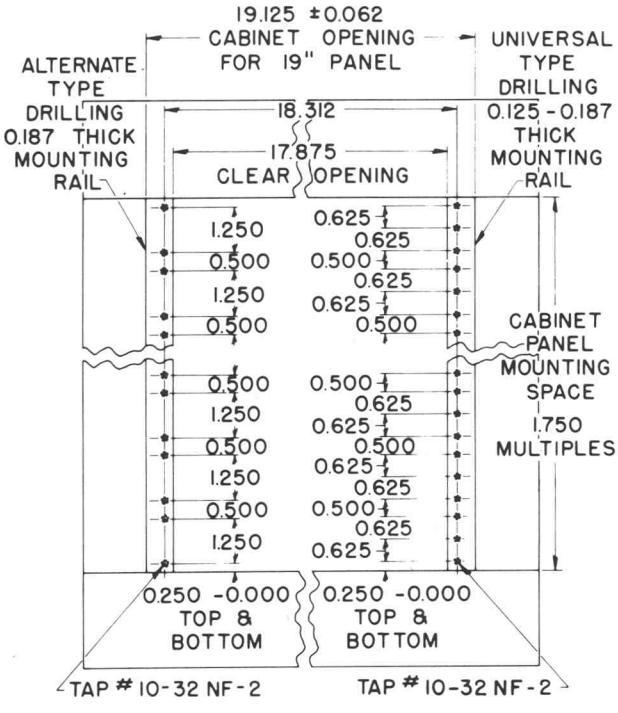
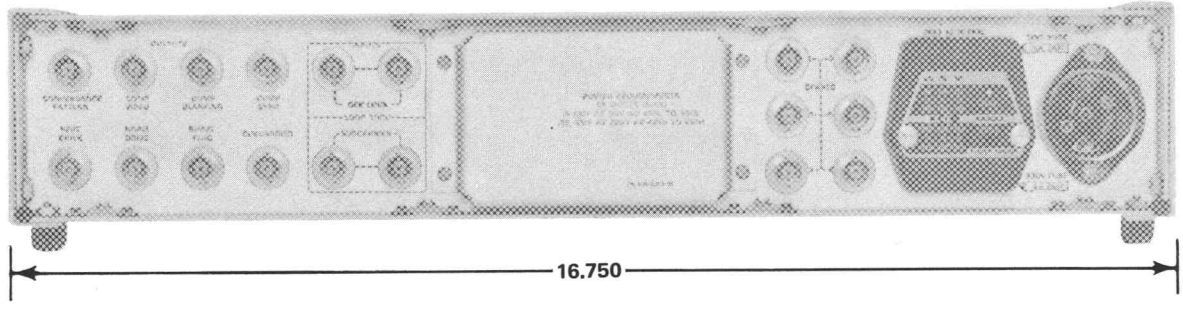
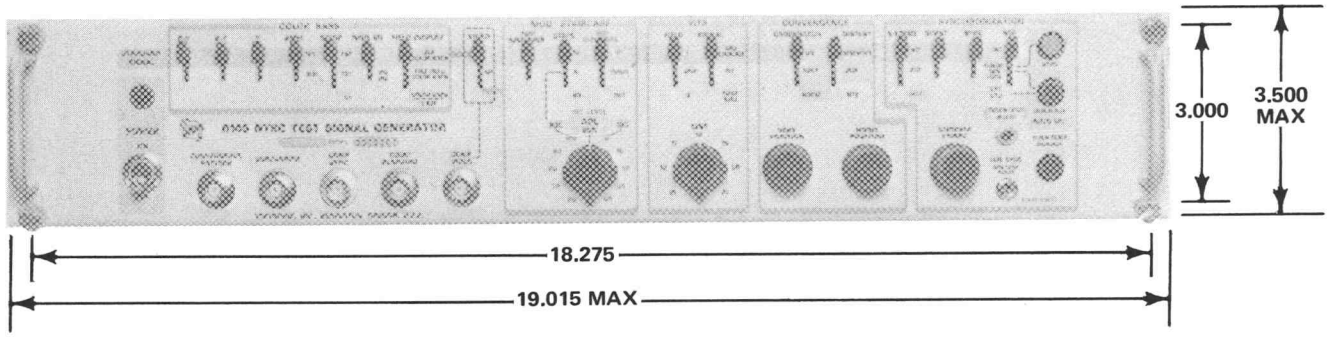


Fig. 5-8. Adjusting the slide-out tracks for smooth sliding action.

RACK RAIL TYPES



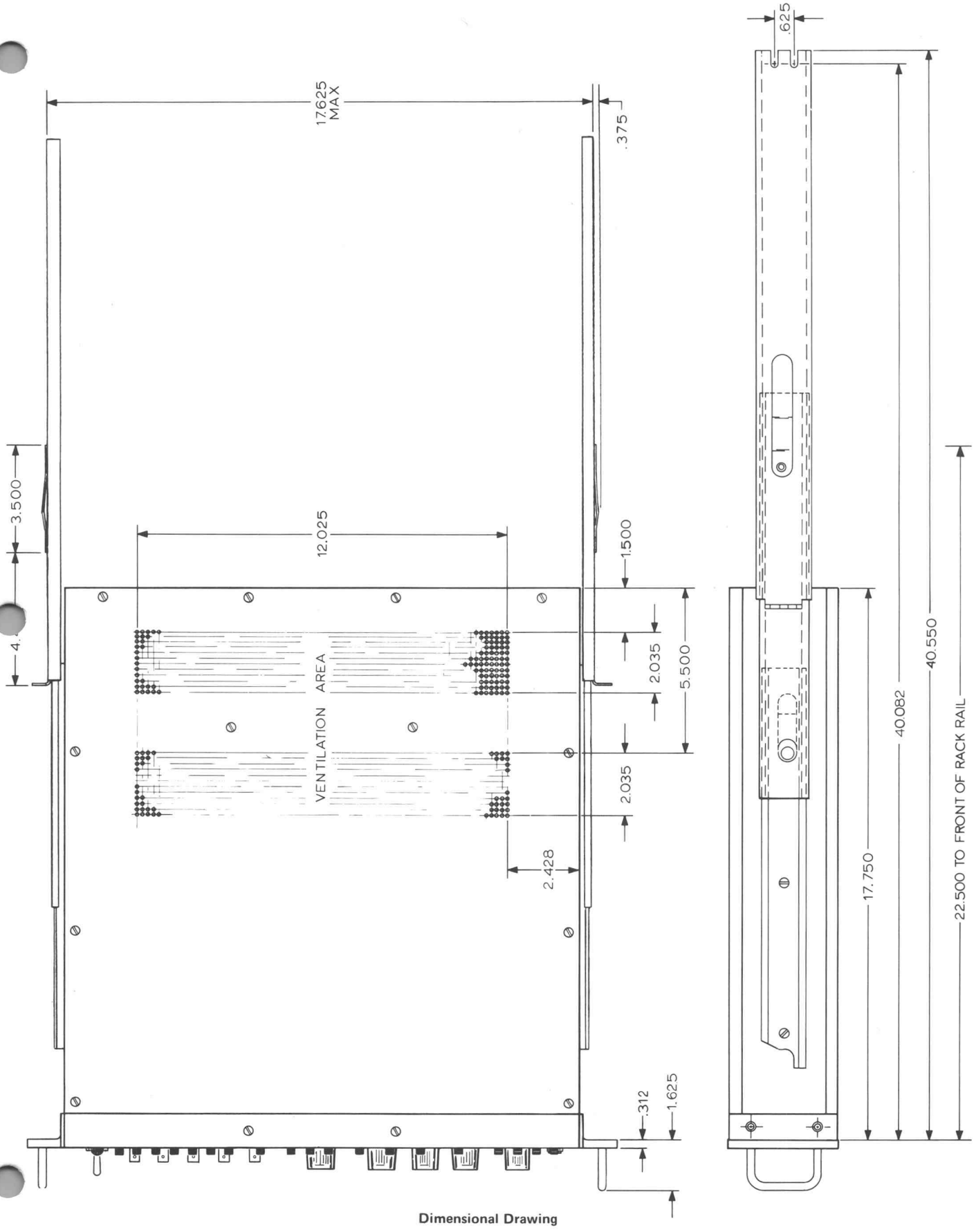




Dimensional Drawing

Ⓐ

Rackmounting—140-Series



Dimensional Drawing

OPTIONS

Purpose

This section is meant to provide for documenting catalog options offered for the 148-M. Custom modifications are negotiated and documented separately.

At the time of initial publication, there were no catalog options offered for the 148-M.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P. O. BOX 128	PICKENS, SC 29671
01002	GENERAL ELECTRIC CO., INDUSTRIAL AND POWER CAPACITOR PRODUCTS DEPT.	JOHN ST.	HUDSON FALLS, NY 12839
01121	ALLEN-BRADLEY CO.	1201 2ND ST. SOUTH	MILWAUKEE, WI 53204
01281	TRW ELECTRONIC COMPONENTS, SEMICONDUCTOR OPERATIONS	14520 AVIATION BLVD.	LAWNDALE, CA 90260
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P. O. BOX 5012	DALLAS, TX 75222
02735	RCA CORP., SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC CO., SEMI-CONDUCTOR PRODUCTS DEPT.	ELECTRONICS PARK	SYRACUSE, NY 13201
03877	TRANSITRON ELECTRONIC CORP.	168 ALBION ST.	WAKEFIELD, MA 01880
04713	MOTOROLA, INC., SEMICONDUCTOR PRODUCTS DIV.	5005 E. MCDOWELL RD.	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS ST.	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPT.	NELA PK.	CLEVELAND, OH 44112
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
11237	CTS KEENE, INC.		PASO ROBLES, CA 93446
12040	NATIONAL SEMICONDUCTOR CORP.	COMMERCE DRIVE	DANBURY, CT 06810
13715	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	4300 REDWOOD HWY.	SAN RAFAEL, CA 94903
15818	TELEDYNE SEMICONDUCTOR	1300 TERRA BELLA AVE.	MOUNTAIN VIEW, CA 94040
24211	GRIGSBY-BARTON INC.	3800 INDUSTRIAL DRIVE	ROLLING MEADOWS, IL 60008
25403	AMPEREX ELECTRONIC CORP., SEMICONDUCTOR AND MICROCIRCUITS DIV.	PROVIDENCE PIKE	SLATERSVILLE, RI 02876
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SAN YSIDRO WAY	SANTA CLARA, CA 95051
28480	HEWLETT-PACKARD CO., CORPORATE HQ.	1501 PAGE MILL RD.	PALO ALTO, CA 94304
32159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	TUCSON, AZ 85706
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	5757 N. GREEN BAY AVE.	MILWAUKEE, WI 53201
71785	TRW ELECTRONIC COMPONENTS, CINCH CONNECTOR OPERATIONS	1501 MORSE AVE.	ELK GROVE VILLAGE, IL 60007
72136	ELECTRO MOTIVE CORP., SUB OF INTERNATIONAL ELECTRONICS CORP.	SOUTH PARK AND JOHN STREETS	WILLIMANTIC, CT 06226
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BlVD.	FULLERTON, CA 92634
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	19070 REYES AVE.	COMPTON, CA 90224
76854	OAK INDUSTRIES, INC., SWITCH DIV.	S. MAIN ST.	CRYSTAL LAKE, IL 60014
78488	STACKPOLE CARBON CO.		ST. MARYS, PA 15857
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
80031	ELECTRA-MIDLAND CORP., MEPCO DIV., A NORTH AMERICAN PHILLIPS CO.	22 COLUMBIA RD.	MORRISTOWN, NJ 07960
80294	BOURNS, INC., INSTRUMENT DIV.	6135 MAGNOLIA AVE.	RIVERSIDE, CA 92506
80740	BECKMAN INSTRUMENTS, INC.	2500 HARBOR BlVD.	FULLERTON, CA 92634
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BlVD.	LOS ANGELES, CA 90069
86684	RCA CORP., ELECTRONIC COMPONENTS	415 S. 5TH ST.	HARRISON, NJ 07029
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY CO., INC.	3029 E. WASHINGTON ST.	INDIANAPOLIS, IN 46206
91418	RADIO MATERIALS CO.	4242 W. BRYN MAWR	CHICAGO, IL 60646
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NB 68601
95712	BENDIX CORP., THE ELECTRICAL COMPONENTS DIV., MICROWAVE DEVICES PLANT	HURRICANE ROAD	FRANKLIN, IN 46131

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A0	670-1468-03			CKT BOARD ASSY:VIT INSERTION	80009	670-1468-03
A1	670-3613-00			CKT BOARD ASSY:VERTICAL COUNTER	80009	670-3613-00
A2	670-2040-04			CKT BOARD ASSY:HORIZONTAL TIMING	80009	670-2040-04
A3	670-2041-02			CKT BOARD ASSY:APL STAIRCASE NOISE	80009	670-2041-02
A4	670-3615-00			CKT BOARD ASSY:VIT AND FULL FIELD	80009	670-3615-00
A5	670-1918-01			CKT BOARD ASSY:GEN LOCK	80009	670-1918-01
A6	670-2039-06			CKT BOARD ASSY:FUNCTION GEN	80009	670-2039-06
A7	670-2042-06			CKT BOARD ASSY:OUTPUT AMP	80009	670-2042-06
A8	670-1915-04			CKT BOARD ASSY:MODULATOR	80009	670-1915-04
A9	670-3614-00			CKT BOARD ASSY:SUBCARRIER AND SYNC OUT	80009	670-3614-00
A10	670-3499-00			CKT BOARD ASSY:FIELD SWEEP	80009	670-3499-00
A11	670-2326-05			CKT BOARD ASSY:EXTERNAL DRIVE	80009	670-2326-05
A12	670-1473-07			CKT BOARD ASSY:POWER SUPPLY	80009	670-1473-07
A13	670-2327-00			CKT BOARD ASSY:RELAY BOARD	80009	670-2327-00
A14	670-1927-03			CKT BOARD ASSY:FILTER	80009	670-1927-03
A15	670-3443-00			CKT BOARD ASSY:BRUCH SEQUENCE	80009	670-3443-00
C18	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	80009	290-0745-00
C24	283-0602-00			CAP,FXD,MICA DI:53PF,5%,300V	00853	D153E530J0
C28	283-0625-00			CAP,FXD,MICA DI:	00853	D105F221F0
C32	283-0596-00			CAP,FXD,MICA DI:528PF,1%,300V	00853	D153F5280F0
C46	283-0632-00			CAP,FXD,MICA DI:87PF,1%,100V	00853	D151E870F0
C55	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C60	290-0528-00			CAP,FXD,ELCTLT:	90201	TDC156M050WLC
C76	283-0239-00			CAP,FXD,CER DI:0.022UF,10%,50V	72982	8131N075WR5223K
C84	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C130	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	80009	290-0745-00
C160	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C194	283-0631-00			CAP,FXD,MICA DI:95PF,1%,100V	00853	D151E950F0
C196	283-0631-00			CAP,FXD,MICA DI:95PF,1%,100V	00853	D151E950F0
C198	283-0239-00			CAP,FXD,CER DI:0.022UF,10%,50V	72982	8131N075WR5223K
C201	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C278	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C290	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C299	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C337	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C374	290-0528-00			CAP,FXD,ELCTLT:	90201	TDC156M050WLC
C407	283-0596-00			CAP,FXD,MICA DI:528PF,1%,300V	00853	D153F5280F0
C413	283-0629-00			CAP,FXD,MICA DI:62PF,1%,500V	00853	D105E620F0
C415	283-0598-00			CAP,FXD,MICA DI:253PF,5%,300V	00853	D153E2530J0
C417	283-0154-00			CAP,FXD,CER DI:22PF,5%,50V	72982	8111A058C0G220J
C434	283-0618-00			CAP,FXD,MICA DI:130PF,2%,300V	00853	D155E131G0
C436	283-0670-00			CAP,FXD,MICA DI:375PF,1%,500V	00853	D155F3750F0
C438	281-0523-00			CAP,FXD,CER DI:100PF(NOM VALUE,SEL)	72982	301-000U2M0101M
C454	283-0680-00			CAP,FXD,MICA DI:330PF,1%,500V	00853	D15-5E331F0
C456	283-0598-00			CAP,FXD,MICA DI:253PF,5%,300V	00853	D153E2530J0
C458	281-0523-00			CAP,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C474	283-0604-00			CAP,FXD,MICA DI:304PF,2%,300V	00853	D153F3040G0
C476	283-0669-00			CAP,FXD,MICA DI:360PF,1%,500V	00853	D155F361F0
C484	283-0623-00			CAP,FXD,MICA DI:1200PF,1%,100V	00853	D191F122F0
C485	283-0660-00			CAP,FXD,MICA DI:510PF,2%,500V	00853	D155F511G0
C487	283-0598-00			CAP,FXD,MICA DI:253PF,5%,300V	00853	D153E2530J0
C494	283-0625-00			CAP,FXD,MICA DI:	00853	D105F221F0

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C513	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C514	283-0194-00			CAP,FXD,CER DI:4.7UF,20%,50V	72982	8151N080651475M
C520	290-0367-00			CAP,FXD,ELCTLT:70UF,20%,6V NONPOLARIZED	56289	30D1802
C537	281-0659-00			CAP,FXD,CER DI:4.3PF,+/-0.25PF,500V	72982	301-000C0H0439C
C558	283-0648-00			CAP,FXD,MICA DI:10PF,5%,100V	00853	D151C100DC
C565	283-0059-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8141N038651105Z
C580	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C593	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C595	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C596	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C598	283-0660-00			CAP,FXD,MICA DI:510PF,2%,500V	00853	D155F511G0
C610	283-0194-00			CAP,FXD,CER DI:4.7UF,20%,50V	72982	8151N080651475M
C614	290-0519-00			CAP,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C620	283-0047-00			CAP,FXD,CER DI:47UF,20%,50V	72982	861-518B271J
C628	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C650	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C692	290-0530-00			CAP,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C693	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C694	290-0527-00			CAP,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C695	281-0523-00			CAP,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C696	283-0639-00			CAP,FXD,MICA DI:56PF,1%,100V	00853	D151E560F0
C718	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C748	281-0645-00			CAP,FXD,CER DI:8.2PF,+/-0.25PF,500V	72982	374-011C0H0829C
C749	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C779	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C790	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C804	285-0684-00			CAP,FXD,PLASTIC:0.056UF,5%,100V	56289	410P106
C822	283-0001-00			CAP,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
C844	283-0134-00			CAP,FXD,CER DI:0.47UF,+80-20%,50V	72982	8141N078651474Z
C849	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C865	281-0504-00			CAP,FXD,CER DI:10PF,+/-1PF,500V	72982	301-000C0G0100F
C879	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C898	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C910	281-0523-00			CAP,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C915	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	00853	D151E151F0
C918	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	00853	D151E151F0
C919	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C927	283-0059-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8141N038651105Z
C929	283-0059-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8141N038651105Z
C959	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C968	283-0672-00			CAP,FXD,MICA DI:200PF,1%,500V	00853	D155F201F0
C978	281-0541-00			CAP,FXD,CER DI:6.8PF,10%,500V	72982	301-000C0H0689D
C989	283-0194-00			CAP,FXD,CER DI:4.7UF,20%,50V	72982	8151N080651475M
C990	281-0523-00			CAP,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C998	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C1001	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1101	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1201	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1301	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1431	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1460	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C1501	285-0835-00			CAP,FXD,PLASTIC:0.22UF,2%,100V	56289	LP66A18224G002
C1515	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D153E471K0

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C1601	283-0058-00			CAP,FXD,CER DI:0.027UF,10%,100V	72982	8131N147W5R273K
C1650	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D153E471K0
C1701	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C1720	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C1730	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C1755	283-0641-00			CAP,FXD,MICA DI:180PF,1%,100V	00853	D151E181F0
C1760	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C1770	283-0593-00			CAP,FXD,MICA DI:0.01UF,1%,100V	00853	D301F103F0
C1780	285-0626-00			CAP,FXD,PLASTIC:0.0015UF,10%,100V	56289	410P102
C1798	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C1895	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1902	283-0622-00			CAP,FXD,MICA DI:450PF,1%,300V	00853	D153F451F0
C1930	283-0615-00			CAP,FXD,MICA DI:33PF,5%,500V	00853	D155E330J0
C1940	283-0680-00			CAP,FXD,MICA DI:330PF,1%,500V	00853	D15-5E331F0
C1950	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1995	281-0562-00			CAP,FXD,CER DI:39PF,10%,500V	72982	301-000U2J0390K
C1998	283-0593-00			CAP,FXD,MICA DI:0.01UF,1%,100V	00853	D301F103F0
C2030	290-0531-00			CAP,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C2730	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D153E471K0
C2929	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C2936	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D153E471K0
C2958	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	00853	D153E471K0
C3001	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3011	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3021	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3083	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C3121	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C3201	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3221	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3231	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C3241	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3242	290-0574-00			CAP.,FXD,ELCTLT:47UF,10%,20V	56289	196D476X9020
C3251	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C3281	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C3283	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3331	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3333	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C3341	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3361	290-0531-00			CAP,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C3381	290-0527-00			CAP,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NLF
C3383	290-0531-00			CAP,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C3421	283-0648-00			CAP,FXD,MICA DI:10PF,5%,100V	00853	D151C100DC
C3431	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3441	283-0645-00			CAP,FXD,MICA DI:790PF,1%,100V	00853	D151E791F0
C3443	283-0645-00			CAP,FXD,MICA DI:790PF,1%,100V	00853	D151E791F0
C3461	283-0647-00			CAP,FXD,MICA DI:70PF,1%,100V	00853	D151E700F0
C3470	281-0131-00			CAP,VAR,AIR DI:	74970	189-509-5
C3473	283-0646-00			CAP,FXD,MICA DI:170PF,1%,100V	00853	D151E171F0
C3491	283-0024-00			CAP,FXD,CER DI:0.1UF,+80-20%,30V	72982	835-000C0H0509D
C3551	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C3565	281-0131-00			CAP,VAR,AIR DI:	74970	189-509-5
C3601	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C3651	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z

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C3881	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C4387	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5034	283-0110-00			CAP,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C5041	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C5043	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5054	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5055	283-0256-00			CAP,FXD,CER DI:	72982	8121B145P3K131J
C5056	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C5063	290-0529-00			CAP,FXD,ELCTLT:47UF,20%,20V	56289	196D476X0020LA3
C5065	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5122	283-0256-00			CAP,FXD,CER DI:	72982	8121B145P3K131J
C5145	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5182	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C5186	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5220	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5225	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C5244	283-0192-00			CAP,FXD,CER DI:0.47UF,+80-20%,3V	91418	MX474Z0304R0
C5257	283-0596-00			CAP,FXD,MICA DI:528PF,1%,300V	00853	D153F5280F0
C5288	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5316	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5332	283-0023-00			CAP,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C5344	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5360	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5364	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C5388	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5414	283-0023-00			CAP,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C5432	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5434	283-0192-00			CAP,FXD,CER DI:0.47UF,+80-20%,3V	91418	MX474Z0304R0
C5458	283-0104-00			CAP,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5475	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5479	283-0017-00			CAP,FXD,CER DI:1UF,+80-20%,3V	91418	MX105Z0304R0
C5522	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5545	283-0104-00			CAP,FXD,CER DI:2000PF,5%,500V	72982	811-565B202J
C5574	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5575	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5577	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5618	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5620	283-0256-00			CAP,FXD,CER DI:	72982	8121B145P3K131J
C5622	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C5625	283-0256-00			CAP,FXD,CER DI:	72982	8121B145P3K131J
C5626	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C5648	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5650	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5674	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5680	283-0110-00			CAP,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C5690	283-0080-00			CAP,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C5718	281-0503-00			CAP,FXD,CER DI:8PF,+/-0.5PF,500V	72982	301-000C0H0809D
C5747	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5788	283-0110-00			CAP,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C5815	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5824	283-0651-00			CAP,FXD,MICA DI:430PF,1%,500V	00853	D155F431F0
C5838	283-0615-00			CAP,FXD,MICA DI:33PF,5%,500V	00853	D155E330J0
C5866	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2

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C5919	283-0659-00			CAP,FXD,MICA DI:	00853	D195C1161G0
C5922	283-0119-00			CAP,FXD,CER DI:2200PF,5%,200V	72982	855-535B222J
C5924	283-0032-00			CAP,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C5929	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C5946	285-0879-00			CAP.,FXD,PLSTC:0.01UF,5%,400V	56289	LP66AIE103JD02
C5950	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5956	290-0415-00			CAP,FXD,ELCTLT:5.6UF,10%,35V	56289	150D565X9035B2
C5991	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C6008	283-0060-00			CAP,FXD,CER DI:100PF,5%,200V	72982	855-535U2J101J
C6047	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C6051	290-0523-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C6071	283-0615-00			CAP,FXD,MICA DI:33PF,5%,500V	00853	D155E330J0
C6078	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	00853	D151E151F0
C6249	281-0523-00			CAP,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C6372	283-0198-00			CAP,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C6382	283-0635-00			CAP,FXD,MICA DI:51PF,1%,100V	00853	D151E510F0
C6486	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C6508	SELECTED					
C6533	283-0643-00			CAP,FXD,MICA DI:	00853	D103C220D0
C6562	281-0510-00			CAP,FXD,CER DI:22PF,+/-4.4PF,500V	72982	301-000C0G0220M
C6606	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C6608	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C6610	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C6614	290-0530-00			CAP,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6663	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C6665	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C6682	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C6693	281-0153-00			CAP,VAR,AIR DI:1.7-10PF,250V	74970	187-0106-005
C6712	290-0530-00			CAP,FXD,ELCTLT:68UF,20%,6V	90201	TDC686M006NLF
C6736	283-0024-00			CAP,FXD,CER DI:0.1UF,+80-20%,30V	72982	835-000C0H0509D
C6740	281-0611-00			CAP,FXD,CER DI:	72982	374-001C0J0279C
C6748	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C6763	283-0024-00			CAP,FXD,CER DI:0.1UF,+80-20%,30V	72982	835-000C0H0509D
C6788	281-0166-00			CAP,VAR,AIR DI:	74970	187-0109-005
C6887	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C6979	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C7212	283-0647-00			CAP,FXD,MICA DI:70PF,1%,100V	00853	D151E700F0
C7301	283-0625-00			CAP,FXD,MICA DI:	00853	D105F221F0
C7303	281-0205-00			CAP,VAR,PLASTIC:5.5-65PF,100V	80031	C010GA/60E
C7305	283-0649-00			CAP,FXD,MICA DI:105PF,1%,300V	00853	D153F1050F0
C7307	283-0596-00			CAP,FXD,MICA DI:528PF,1%,300V	00853	D153F5280F0
C7309	283-0636-00			CAP,FXD,MICA DI:36PF,1.4%,100V	00853	D151E360G0
C7310	283-0647-00			CAP,FXD,MICA DI:70PF,1%,100V	00853	D151E700F0
C7311	283-0649-00			CAP,FXD,MICA DI:105PF,1%,300V	00853	D153F1050F0
C7312	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	00853	D151E151F0
C7381	283-0641-00			CAP,FXD,MICA DI:180PF,1%,100V	00853	D151E181F0
C7383	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C7401	283-0635-00			CAP,FXD,MICA DI:51PF,1%,100V	00853	D151E510F0
C7403	283-0632-00			CAP,FXD,MICA DI:87PF,1%,100V	00853	D151E870F0
C7431	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C7451	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C7452	SELECTED					
C7461	281-0166-00			CAP,VAR,AIR DI:	74970	187-0109-005

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C7463	281-0166-00			CAP,VAR,AIR DI:	74970	187-0109-005
C7481	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C7491	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C7501	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V	00853	D153C220K0
C7503	283-0674-00			CAP,FXD,MICA DI:85PF,1%,500V	00853	D155F850F0
C7505	283-0663-00			CAP,FXD,MICA DI:16.8PF,+/0.5PF,500V	00853	D155C16.8D0
C7507	283-0600-00			CAP,FXD,MICA DI:43PF,5%,500V	00853	D105E430J0
C7508	283-0639-00			CAP,FXD,MICA DI:56PF,1%,100V	00853	D151E560F0
C7509	283-0618-00			CAP,FXD,MICA DI:130PF,2%,300V	00853	D155E131G0
C7546	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C7551	283-0065-00			CAP,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C7555	283-0687-00			CAP,FXD,MICA DI:560PF,2%,300V	72136	DM15E561G0300
C7575	SELECTED					
C7601	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V	00853	D153C220K0
C7603	283-0635-00			CAP,FXD,MICA DI:51PF,1%,100V	00853	D151E510F0
C7671	283-0065-00			CAP,FXD,CER DI:0.001UF,5%,100V	72982	805-505B102J
C7681	290-0367-00			CAP,FXD,ELCTLT:70UF,20%,6V NONPOLARIZED	56289	30D1802
C7711	290-0524-00			CAP,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C7731	283-0644-00			CAP,FXD,MICA DI:150PF,1%,500V	00853	D151E151F0
C7781	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C7783	290-0531-00			CAP,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010WLC
C7791	281-0661-00			CAP,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0G0808B
C7801	281-0626-00			CAP,FXD,CER DI:3.3PF,1%,500V	72982	301-000C0J0339B
C7803	283-0598-00			CAP,FXD,MICA DI:253PF,5%,300V	00853	D153E2530J0
C7861	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C7883	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C7891	283-0637-00			CAP,FXD,MICA DI:20PF,2.5%,100V	00853	D151E200D0
C7901	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C7903	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C7932	283-0164-00			CAP,FXD,CER DI:	72982	8141N038651225M
C7951	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C8009	283-0594-00			CAP,FXD,MICA DI:0.001UF,1%,100V	00853	D151F102F0
C8118	283-0599-00			CAP,FXD,MICA DI:98PF,5%,500V	00853	D105E980J0
C8288	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C8294	283-0728-00			CAP,FXD,MICA DI:120PF,1%,500V	00853	DM15-5F121F0
C8324	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C8342	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C8350	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C8354	283-0672-00			CAP,FXD,MICA DI:200PF,1%,500V	00853	D155F201F0
C8362	283-0728-00			CAP,FXD,MICA DI:120PF,1%,500V	00853	DM15-5F121F0
C8364	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C8382	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C8421	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C8424	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C8472	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J
C8480	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V	00853	D153C220K0
C8488	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V	00853	D153C220K0
C8498	283-0618-00			CAP,FXD,MICA DI:130PF,2%,300V	00853	D155E131G0
C8558	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J
C8574	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J
C8642	283-0054-00			CAP,FXD,CER DI:	72982	855-535U2J151J
C8652	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J
C8654	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	72982	838-533B271J

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C8674	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C8689	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	72982	855-547E203Z
C8698	281-0064-00			CAP,VAR,PLASTIC:0.25-1.5PF,600V	72982	530-002
C8710	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039651105Z
C8832	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V	00853	D153C220K0
C8854	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C8972	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C8997	281-0116-00			CAP,VAR,AIR DI:1.6-9.1PF,425V	74970	189-0354-075
C9011	290-0334-00			CAP,FXD,ELCTLT:1250UF,+75-10%,50V	56289	D46468
C9042	290-0632-00			CAP,FXD,ELCTLT:6200UF,+75-10%,15V	56289	39D357
C9044	290-0632-00			CAP,FXD,ELCTLT:6200UF,+75-10%,15V	56289	39D357
C9061	290-0633-00			CAP,FXD,ELCTLT:	56289	39D360
C9082	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C9084	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C9086	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C9088	281-0625-00			CAP,FXD,CER DI:35PF,5%,500V	72982	308-000C0G0350J
C9209	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C9215	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C9218	283-0003-00			CAP,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C9621	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	72982	8131N075651104M
C9676	285-0809-00			CAP,FXD,PLASTIC:1UF,10%,50V	56289	LP66A1A105K
C9684	285-0683-00			CAP,FXD,PLASTIC:0.022UF,5%,100V	56289	410P22351
C9719	281-0168-00			CAP,VAR,AIR DI:1.3-5.4PF,250V	74970	187-0103-035
C9726	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C9729	281-0543-00			CAP,FXD,CER DI:270PF,10%,500V	72982	301-055X5P1271K
C9745	283-0605-00			CAP,FXD,MICA DI:678PF,1%,300V	00853	D153F6780F0
C9753	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C9757	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C9766	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C9787	281-0511-00			CAP,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C9794	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C9798	283-0144-00			CAP,FXD,CER DI:33PF,1%,500V	72982	801-457P2G330F
C9799	283-0178-00			CAP,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C9802	285-0598-00			CAP,FXD,PLASTIC:0.01UF,5%,100V	01002	61F10AC103
C9810	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9824	290-0296-00			CAP,FXD,ELCTLT:100UF,20%,20V	56289	150D107X0020S2
C9830	285-0598-00			CAP,FXD,PLASTIC:0.01UF,5%,100V	01002	61F10AC103
C9831	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C9832	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9840	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C9850	290-0135-00			CAP,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C9852	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	56289	274C3
C9854	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C9856	285-0598-00			CAP,FXD,PLASTIC:0.01UF,5%,100V	01002	61F10AC103
CR7	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR48	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR268	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR332	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR372	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR390	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR452	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR454	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR456	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR477	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR485	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR498	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR499	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR584	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR585	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR588	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR651	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR662	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR664	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR720	152-0269-00			SEMICOND DVC,DI:SILICON,VAR VCAP.,4V,33PF	25403	1N3182
CR740	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR796	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR924	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR944	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR992	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1405	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1510	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1720	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1740	152-0269-00			SEMICOND DVC,DI:SILICON,VAR VCAP.,4V,33PF	25403	1N3182
CR1795	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1830	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR1930	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3351	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3411	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3413	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3451	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3531	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3533	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3551	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3641	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3651	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3653	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3711	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR3721	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3723	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3725	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3811	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR3821	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3823	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3881	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3911	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR3913	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3920	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3921	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR3923	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR4390	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5010	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5012	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5038	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5040	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5253	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR5258	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5274	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5276	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5334	152-0322-00			SEMICOND DVC,DI:SILICON,15V	28480	5082-2672
CR5338	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5340	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5362	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5372	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5417	152-0322-00			SEMICOND DVC,DI:SILICON,15V	28480	5082-2672
CR5419	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5480	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5490	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5492	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5521	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5572	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5576	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5651	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5660	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5667	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5858	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5874	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5931	152-0269-00			SEMICOND DVC,DI:SILICON,VAR VCAP.,4V,33PF	25403	1N3182
CR5935	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5952	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5974	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5981	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5984	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5985	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR5997	152-0008-00			SEMICOND DVC,DI:75V,60MA	03877	T-12G
CR6013	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6017	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6019	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6022	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6028	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6033	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6037	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6048	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6112	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6113	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6114	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6118	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6122	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6128	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6132	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6136	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6182	152-0125-00			SEMICOND DVC,DI:TUNNEL,15PF,4.7MA	03508	STD704
CR6306	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6308	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6316	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6318	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6322[1]	152-0442-00			SEMICOND DVC,DI:	80009	152-0442-00
CR6328[1]	152-0442-00			SEMICOND DVC,DI:	80009	152-0442-00
CR6331	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003

[1]Matched pair.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR6335	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6338	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6344	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6348[1]	152-0442-00			SEMICOND DVC,DI:	80009	152-0442-00
CR6376	152-0322-00			SEMICOND DVC,DI:SILICON,15V	28480	5082-2672
CR6404[1]	152-0442-00			SEMICOND DVC,DI:	80009	152-0442-00
CR6466	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6469	152-0457-00			SEMICOND DVC,DI:SILICON	28480	5082-2671
CR6588	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6603	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6624	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6634	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6703	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6705	152-0153-00			SEMICOND DVC,DI:SILICON,15V,50MA	13715	FD7003
CR6709	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6789	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6885	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6913	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6915	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6918	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6920	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6923	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6925	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6987	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR6988	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7008	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7041	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7091	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7093	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7095	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7190	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7215	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7218	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7491	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7581	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7593	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7711	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR7951	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8086	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8124	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8126	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8180	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8182	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8184	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8188	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8194	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8224	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8226	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8228	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8246	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8248	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8291	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8293	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152

[1]Matched pair.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR8332	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8346	152-0269-00			SEMICOND DVC,DI:SILICON,VAR VCAP.,4V,33PF	25403	1N3182
CR8384	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8385	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8520	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8524	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8536	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8910	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR8924	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9609	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9723	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9724	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9727	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9737	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9742	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9743	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9754	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9756	152-0141-02			SEMICOND DVC,DI:SILICON,30V,150MA	07910	1N4152
CR9802	152-0198-00			SEMICOND DVC,DI:SILICON,40PPV,150MA	04713	1N4721
CR9804	152-0198-00			SEMICOND DVC,DI:SILICON,40PPV,150MA	04713	1N4721
CR9830	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9832	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9834	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9836	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9870	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9872	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9874	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
CR9876	152-0066-00			SEMICOND DVC,DI:SILICON,400V,7 50MA	02735	37304
DS9201	150-0048-00			LAMP,INCAND:5V,60MA	08806	683
DS9202	150-0048-00			LAMP,INCAND:5V,60MA	08806	683
DS9210	150-0048-00			LAMP,INCAND:5V,60MA	08806	683
DS9211	150-0048-00			LAMP,INCAND:5V,60MA	08806	683
DS9212	150-0048-00			LAMP,INCAND:5V,60MA	08806	683
F9201	159-0042-00			FUSE,CARTRIDGE:3AG,0.75A,250V,0.15SEC	71400	AGC3-4
F9202	159-0025-00			FUSE,CARTRIDGE:3AG,0.5A,250V,0.25SEC	71400	AGC1-2
FL9201	119-0095-06			FILTER,RFI:	56289	JN10-2319A1
J9001	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9002	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9003	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9004	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9005	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9006	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9007	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9009	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9011	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9012	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9014	131-0324-00			CONN,RCPT,ELEC:24 PIN,FEMALE FEMALE,24 PIN	71785	57-40240(398)
J9016	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9018	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9020	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9210	131-0106-02			CONN,RCPT,ELEC:BNC	80009	131-0106-02

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
J9240	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	95712	9663-INT34
J9250	131-0106-02			CONN,RCPT,ELEC:BNC	80009	131-0106-02
K370	148-0064-00			RELAY,RESN REED:	24211	CB-831A-26
K9080	148-0034-00			RELAY,ARMATURE:DPDT,600 OHM,15VDC	80009	148-0034-00
K9792	148-0086-00			RELAY,REED:	24211	GB835C-1
L20	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L120	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L190	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L415	114-0219-00			COIL,RF:	80009	114-0219-00
L435	114-0219-00			COIL,RF:	80009	114-0219-00
L455	114-0219-00			COIL,RF:	80009	114-0219-00
L475	114-0259-00			COIL,RF:	80009	114-0259-00
L520	276-0507-00			SHLD BEAD,ELEK:0.6UH	78488	57-0180-7D
L720	108-0226-00			COIL,RF:100UH	76493	DWG B4257
L912	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1670	114-0308-00			COIL,RF:2.9-6.5UH	80009	114-0308-00
L1770	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L1850	108-0174-00			COIL,RF:	80009	108-0174-00
L3070	108-0395-00			COIL,RF:64UH	80009	108-0395-00
L5056	108-0317-00			COIL,RF:15UH	32159	71501M
L5100	114-0303-00			COIL,RF:6.5-23UH,CORE276-0506-00	80009	114-0303-00
L5340	108-0174-00			COIL,RF:	80009	108-0174-00
L5420	108-0174-00			COIL,RF:	80009	108-0174-00
L5610	108-0317-00			COIL,RF:15UH	32159	71501M
L5830	108-0231-00			COIL,RF:4.5UH	80009	108-0231-00
L6482	276-0507-00			SHLD BEAD,ELEK:0.6UH	78488	57-0180-7D
L6852	276-0507-00			SHLD BEAD,ELEK:0.6UH	78488	57-0180-7D
L7110	120-0785-00			XFMR,TOROID:12 TURN BIFILAR	80009	120-0785-00
L7301	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7311	114-0222-00			COIL,RF:2-6UH,CORE 276-0568-00	80009	114-0222-00
L7321	276-0507-00			SHLD BEAD,ELEK:0.6UH	78488	57-0180-7D
L7391	108-0249-00			COIL,RF:	76493	70F125A1
L7401	114-0278-00			COIL,RF:4.6-16.7UH	80009	114-0278-00
L7411	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7501	114-0278-00			COIL,RF:4.6-16.7UH	80009	114-0278-00
L7511	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7601	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L7611	114-0220-00			COIL,RF:1-3UH,CORE 276-0568-00	80009	114-0220-00
L7631	108-0443-00			COIL,RF:25UH	80009	108-0443-00
L8140	114-0310-00			COIL,RF:00	80009	114-0310-00
L8150	114-0310-00			COIL,RF:00	80009	114-0310-00
L8381	114-0219-00			COIL,RF:	80009	114-0219-00
L8580	114-0310-00			COIL,RF:00	80009	114-0310-00
L8590	114-0241-00			COIL,RF:	80009	114-0241-00
L8630	114-0280-00			COIL,RF:12-43UH,CORE 276-0568-00	80009	114-0280-00
L8660	120-0587-00			XFMR,TOROID:FOUR 10 TURN WINDINGS	80009	120-0587-00
L8680	120-0524-00			XFMR,TOROID:12 TURN QUADRAFILAR	80009	120-0524-00
L8730	114-0219-00			COIL,RF:	80009	114-0219-00
L9710	114-0218-00			COIL,RF:70-120 UH	80009	114-0218-00
L9772	114-0310-00			COIL,RF:00	80009	114-0310-00
Q21	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q61	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q71	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q81	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q91	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q141	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q151	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q171	151-0225-00			TRANSISTOR:SILICON,NPN	07910	CS23365
Q181	151-0225-00			TRANSISTOR:SILICON,NPN	07910	CS23365
Q271	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q321	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q331	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q351	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q381	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q391	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q394	151-0195-00			TRANSISTOR:SILICON,NPN	80009	151-0195-00
Q398	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q406	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q408	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q411	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q421	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q428	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q449	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q466	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q498	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q499	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q510	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q520	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q540	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q550	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q560	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q565	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q570	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q580	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q620	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q630	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q640	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q658	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q680	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q730	151-0104-00			TRANSISTOR:	07263	SP8481
Q740	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q750	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q760	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q790	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q820	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHAN	04713	2N5462
Q840	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q860	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q880	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q885	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q900	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q905	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q920	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q930	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q950	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523
Q960	151-0216-00			TRANSISTOR:SILICON,PNP	04713	MPS6523

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q965	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q980	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q990	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1411	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1421	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1501	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1601	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1631	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1691	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1701	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1731	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1741	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1791	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1801	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1811	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1901	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1911	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1921	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q1991	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3040	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3050	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3060	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3070	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3110	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3130	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3210	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3240	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q3250	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3300	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3360	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3370	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q3420	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3430	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q3440	151-1039-00			TRANSISTOR:SILICON,JFE,P-CHAN	04713	2N5462
Q3450	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q3470	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q3510	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q3520	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q3530	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q3540	151-0269-00			TRANSISTOR:SILICON,NPN,SEL FROM SE3005	80009	151-0269-00
Q3545	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q3580	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q3600	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3610	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q3645	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q3720	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3780	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q3820	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3825	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3880	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3890	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q3920	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q4071	151-0195-00			TRANSISTOR:SILICON,NPN	80009	151-0195-00
Q4081	151-0195-00			TRANSISTOR:SILICON,NPN	80009	151-0195-00
Q4091	151-0195-00			TRANSISTOR:SILICON,NPN	80009	151-0195-00
Q5021	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5031	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5041	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
Q5051	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
Q5091	151-0224-00			TRANSISTOR:SILICON,NPN	07263	2N3904
Q5121	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5141	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5151	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q5161	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5171	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5181	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5187	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5191	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q5197	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5231	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5251	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5261	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5271	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5281	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5287	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q5331	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q5361	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q5371	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5381	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5387	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5391	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5411	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q5421	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5431	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5441	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5447	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5451	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5457	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5461	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5467	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5481	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5487	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5491	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5511	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5521	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q5551	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
Q5561	151-0224-00			TRANSISTOR:SILICON,NPN	07263	2N3904
Q5571	151-0224-00			TRANSISTOR:SILICON,NPN	07263	2N3904
Q5581	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5587	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q5591	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q5597	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5651	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5671	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5681	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q5691	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5697	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5721	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5731	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q5751	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5781	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5831	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q5841	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5851	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5857	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5861	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5871	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5877	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5881	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5887	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5891	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5921	151-0207-00			TRANSISTOR:SILICON,NPN	03508	GET3415
Q5931	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5937	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5941	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q5951	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5961	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5971	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5981	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q5987	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q5991	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q5997	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6010	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6068	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q6091	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q6095	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6103	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S6075
Q6106	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6149	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6162	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q6164	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q6192	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q6198	151-0221-00			TRANSISTOR:SILICON,PNP	80009	151-0221-00
Q6212	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6222	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6228	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6233	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6244	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6255	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6262	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q6266	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q6298	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6392	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6398	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q6478	151-0133-00			TRANSISTOR:	80009	151-0133-00
Q6482	151-0271-00			TRANSISTOR:SILICON,PNP	01295	SKA4504
Q6494	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q6496	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q6569	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6593	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q6624	151-0361-00			TRANSISTOR:	56289	TD702
Q6653	151-0236-00			TRANSISTOR:	15818	SA2700
Q6715	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6758	151-0271-00			TRANSISTOR:SILICON,PNP	01295	SKA4504
Q6786	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q6803	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6813	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6824	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6828	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q6852	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q6858	151-0271-00			TRANSISTOR:SILICON,PNP	01295	SKA4504
Q6877	152-0271-00			SEMICOND DVC,DI:	01281	V10E
Q7001	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7191	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
Q7221	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7241	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7321	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7331	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7431	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q7481	151-0269-00			TRANSISTOR:SILICON,NPN,SEL FROM SE3005	80009	151-0269-00
Q7531	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q7551	151-0269-00			TRANSISTOR:SILICON,NPN,SEL FROM SE3005	80009	151-0269-00
Q7571	151-0269-00			TRANSISTOR:SILICON,NPN,SEL FROM SE3005	80009	151-0269-00
Q7630	151-0236-00			TRANSISTOR:	15818	SA2700
Q7651	151-0269-00			TRANSISTOR:SILICON,NPN,SEL FROM SE3005	80009	151-0269-00
Q7711	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q7763	151-0236-00			TRANSISTOR:	15818	SA2700
Q7771	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q7781	151-0271-00			TRANSISTOR:SILICON,PNP	01295	SKA4504
Q7783	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q7811	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q7911	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q7921	151-0103-00			TRANSISTOR:SILICON,NPN	04713	2N2219A
Q7961	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q7971	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q7981	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q8150	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8158	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8166	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8171	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q8172	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q8261	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8279	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q8281	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q8321	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8371	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q8461	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q8471	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8571	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8579	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8641	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q8679	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q8851A,B	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q8871A,B	151-0236-00			TRANSISTOR:	15818	SA2700
Q8911	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q9035	151-0349-00			TRANSISTOR:SILICON,NPN SEL FROM MJE2801	04713	SJE924
Q9055	151-0349-00			TRANSISTOR:SILICON,NPN SEL FROM MJE2801	04713	SJE924
Q9085	151-0349-00			TRANSISTOR:SILICON,NPN SEL FROM MJE2801	04713	SJE924
Q9670	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q9692	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9714	151-0230-00			TRANSISTOR:	02735	38520
Q9716	151-0230-00			TRANSISTOR:	02735	38520
Q9735	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q9745	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9776	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q9778	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	80009	151-0192-00
Q9800	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q9802	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q9804	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9806	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9830	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q9832	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q9834	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9836	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9850	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q9852	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q9854	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q9856	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
R3	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R5	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R7	321-0239-07			RES,FXD,FILM:3.01K OHM,0.1%,0.125W	75042	CEAT9-3011B
R20	315-0220-00			RES,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R40	321-0277-00			RES,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R42	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R44	321-0105-00			RES,FXD,FILM:121 OHM,1%,0.125W	75042	CEAT0-1210F
R61	322-0085-00			RES,FXD,FILM:75.0 OHM,1%,0.25W,TC=T0	75042	CEBT0-75R00F
R62	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R68	315-0563-00			RES,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R70	321-0312-00			RES,FXD,FILM:17.4K OHM,1%,0125W	75042	CEAT0-1742F
R72	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R74	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R78	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R94	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R96	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R142	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R144	321-0275-00			RES,FXD,FILM:7.15K OHM,1%,0.125W	75042	CEAT0-7151F
R162	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R164	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R166	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R168	321-0293-00			RES,FXD,FILM:11K OHM,1%,0.125W	75042	CEAT0-1102F
R172	321-0277-00			RES,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R174	321-0235-00			RES,FXD,FILM:2.74K OHM,1%,0.125W	75042	CEAT0-2741F
R176	321-0235-00			RES,FXD,FILM:2.74K OHM,1%,0.125W	75042	CEAT0-2741F

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R178	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R231	321-0243-00			RES,FXD,FILM:3.32K OHM,1%,0.125W	75042	CEAT0-3321F
R234	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R236	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R238	321-0274-00			RES,FXD,FILM:6.98K OHM,1%,0.125W	75042	CEAT0-6981F
R251	311-1225-00			RES,VAR,NONWW:TRMR,1K OHM,0.5W	80294	3389F-P31-102
R260	308-0252-00			RES,FXD,WW:390 OHM,5%,3W	91637	RS2B-B390R0J
R265	315-0432-00			RES,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R267	315-0753-00			RES,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R284	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R294	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R296	315-0301-00			RES,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R298	322-0085-00			RES,FXD,FILM:75.0 OHM,1%,0.25W,TC=T0	75042	CEBT0-75R00F
R312	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R329	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R334	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R336	321-0344-00			RES,FXD,FILM:37.4K OHM,1%,0.125W	75042	CEAT0-3742F
R338	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R351	311-1226-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	80294	3389F-P31-252
R356	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80294	3389F-P31-103
R358	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R362	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R364	315-0270-00			RES,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R366	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R368	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R377	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R379	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R382	315-0112-00			RES,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R384	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R386	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R387	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R399	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R407	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R408	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R409	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R415	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R416	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R418	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R420	321-0316-00			RES,FXD,FILM:19.1K OHM,1%,0.125KW	75042	CEAT0-1912F
R428	321-0312-00			RES,FXD,FILM:17.4K OHM,1%,0125W	75042	CEAT0-1742F
R429	321-0812-07			RES,FXD,FILM:455 OHM,0.1%,0.125W	75042	CEAT9-4550B
R434	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R440	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R455	315-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R458	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R462	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R464	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R471	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R473	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R480	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R482	311-1269-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	73138	62PT-352-0
R486	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R488	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535

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R496	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R497	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R498	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R499	321-0273-00			RES,FXD,FILM:6.81K OHM,1%,0.125W	75042	CEAT0-6811F
R501	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R504	321-0176-00			RES,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R505	311-1261-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80294	3329P-L58-501
R512	321-0157-00			RES,FXD,FILM:422 OHM,1%,0.125W	75042	CEAT0-4220F
R520	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R525	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R526	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R528	315-0221-00			RES,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R530	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R550	321-0152-00			RES,FXD,FILM:374 OHM,1%,0.125W	75042	CEAT0-3740F
R552	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R553	321-0296-00			RES,FXD,FILM:11.8K OHM,1%,0.125W	75042	CEAT0-1182F
R555	321-0085-01			RES,FXD,FILM:75 OHM,0.5%,0.125W	91637	MFF1816G75R00D
R562	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R566	321-0241-00			RES,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R576	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R583	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R586	315-0911-00			RES,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R587	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R588	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R592	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R594	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R596	315-0561-00			RES,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R597	315-0911-00			RES,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R598	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R612	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R618	315-0106-00			RES,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R619	301-0681-00			RES,FXD,CMPSN:680 OHM,5%,0.50W	01121	EB6815
R625	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R627	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R630	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R642	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R654	321-0171-00			RES,FXD,FILM:590 OHM,1%,0.125W	75042	CEAT0-5900F
R658	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R659	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R662	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R666	315-0561-00			RES,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R668	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R670	321-0171-00			RES,FXD,FILM:590 OHM,1%,0.125W	75042	CEAT0-5900F
R674	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R676	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R677	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R684	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R690	315-0911-00			RES,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R692	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R693	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R694	315-0680-00			RES,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R698	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R707	315-0563-00			RES,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635

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R710	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R711	315-0823-00			RES,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R713	315-0823-00			RES,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R714	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R716	315-0823-00			RES,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R718	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R720	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R735	311-1272-00			RES,VAR,NONWW:TRMR,100K OHM,0.5W	73138	62PT-355-0
R740	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R746	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R748	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R749	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R750	321-0131-00			RES,FXD,FILM:226 OHM,1%,0.125W	75042	CEAT0-2260F
R754	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R756	321-0183-00			RES,FXD,FILM:787 OHM,1%,0.125W	75042	CEAT0-7870F
R757	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R759	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R765	311-1260-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	73138	62PT-345-0
R766	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R770	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R772	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R773	315-0123-00			RES,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R774	321-0131-00			RES,FXD,FILM:226 OHM,1%,0.125W	75042	CEAT0-2260F
R775	311-1271-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	73138	62PT-354-0
R785	311-1271-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	73138	62PT-354-0
R786	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R790	308-0542-00			RES.,FXD,WW:500 OHM,0.1%,3W	91637	RS2B-B500R0B
R797	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R806	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R808	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R817	321-0372-00			RES,FXD,FILM:73.2K OHM,1%,0.125W	75042	CEAT0-7322F
R819	321-0374-00			RES,FXD,FILM:76.8K OHM,1%,0.125W	75042	CEAT0-7682F
R820	315-0474-00			RES,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R821	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R840	321-0238-00			RES,FXD,FILM:2.94K OHM,1%,0.125W	75042	CEAT0-2941F
R842	321-0165-00			RES,FXD,FILM:511 OHM,1%,0.125W	75042	CEAT0-5110F
R843	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R845	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R847	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R848	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R849	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R850	321-0171-00			RES,FXD,FILM:590 OHM,1%,0.125W	75042	CEAT0-5900F
R854	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R856	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R862	315-0221-00			RES,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R863	321-0239-00			RES,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R868	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R870	321-0171-00			RES,FXD,FILM:590 OHM,1%,0.125W	75042	CEAT0-5900F
R872	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R874	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R876	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R883	301-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R888	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R890	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R893	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R895	311-1261-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80294	3329P-L58-501
R896	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R897	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R898	308-0542-00			RES.,FXD,WW:500 OHM,0.1%,3W	91637	RS2B-B500R0B
R906	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R908	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R910	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R912	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R915	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R917	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R919	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R920	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R926	315-0563-00			RES,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R928	315-0221-00			RES,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R940	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R942	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R943	321-0131-00			RES,FXD,FILM:226 OHM,1%,0.125W	75042	CEAT0-2260F
R950	321-0183-00			RES,FXD,FILM:787 OHM,1%,0.125W	75042	CEAT0-7870F
R952	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R954	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R955	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R957	321-0238-00			RES,FXD,FILM:2.94K OHM,1%,0.125W	75042	CEAT0-2941F
R958	321-0165-00			RES,FXD,FILM:511 OHM,1%,0.125W	75042	CEAT0-5110F
R959	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R965	311-1260-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	73138	62PT-345-0
R966	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R969	315-0221-00			RES,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R970	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R971	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W	75042	CEAT2-5000C
R972	315-0123-00			RES,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R973	321-0131-00			RES,FXD,FILM:226 OHM,1%,0.125W	75042	CEAT0-2260F
R975	311-1271-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	73138	62PT-354-0
R976	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R977	321-0239-00			RES,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R978	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R979	301-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.50W	01121	EB1225
R985	311-1271-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	73138	62PT-354-0
R993	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R994	315-0680-00			RES,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
R995	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R996	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R997	315-0241-00			RES,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R1000	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1098	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1251	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1301	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1365	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1395	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1400	315-0185-00			RES,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
R1401	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1501	315-0275-00			RES,FXD,CMPSN:2.7M OHM,5%,0.25W	01121	CB2755

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R1502	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1520	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1530	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1601	321-0255-00			RES,FXD,FILM:4.42K OHM,1%,0.125W	75042	CEAT0-4421F
R1602	321-0270-00			RES,FXD,FILM:6.34K OHM,1%,0.125W	75042	CEAT0-6341F
R1630	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1631	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1632	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R1650	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1655	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R1695	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R1701	315-0513-00			RES,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R1710	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1715	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R1720	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R1721	315-0124-00			RES,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R1725	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1730	315-0474-00			RES,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R1732	315-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
R1735	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1740	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R1750	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R1755	315-0622-00			RES,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R1760	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1791	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R1793	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R1795	315-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R1798	315-0821-00			RES,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R1799	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R1805	315-0113-00			RES,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R1810	321-0255-00			RES,FXD,FILM:4.42K OHM,1%,0.125W	75042	CEAT0-4421F
R1820	321-0270-00			RES,FXD,FILM:6.34K OHM,1%,0.125W	75042	CEAT0-6341F
R1830	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1835	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R1840	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R1890	315-0203-00			RES,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R1893	321-0312-00			RES,FXD,FILM:17.4K OHM,1%,0125W	75042	CEAT0-1742F
R1900	315-0432-00			RES,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R1903	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R1930	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R1935	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R1940	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R1950	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1955	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R1988	311-0607-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80740	62-59-3
R1990	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1991	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R1998	315-0240-00			RES,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R2701	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2715	311-0607-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80740	62-59-3
R2720	321-0286-00			RES,FXD,FILM:9.31K OHM,1%,0.125W	75042	CEAT0-9311F
R2724	321-0308-00			RES,FXD,FILM:15.8K OHM,1%,0.125W	75042	CEAT0-1582F
R2734	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015

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R2882	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2910	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2915	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2918	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R2920	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2922	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2932	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2934	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2970	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2978	301-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.50W	01121	EB2725
R2980	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3001	321-0306-00			RES,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R3003	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3005	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3007	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3013	315-0123-00			RES,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R3021	321-0082-00			RES,FXD,FILM:69.8 OHM,1%,0.125W	75042	CEAT0-69R80F
R3031	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	75042	CEAT0-49R90F
R3041	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3043	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3051	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3061	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3071	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3081	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3083	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3121	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R3123	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R3125	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3126	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3141	315-0180-00			RES.,FXD,CMPSN:18 OHM,5%,0.25W	01121	CB1805
R3151	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3153	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3161	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R3163	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3165	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3171	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R3181	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3183	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R3185	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3186	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R3211	315-0511-00			RES,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3221	315-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R3223	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3225	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3227	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R3241	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3260	311-1225-00			RES,VAR,NONWW:TRMR,1K OHM,0.5W	80294	3389F-P31-102
R3270	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R3271	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R3281	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3283	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3285	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3311	321-0361-00			RES,FXD,FILM:56.2K OHM,1%,0.125W	75042	CEAT0-5622F

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R3321	315-0511-00			RES,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R3323	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3325	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R3331	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R3335	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R3337	321-0375-00			RES,FXD,FILM:78.7K OHM,1%,0.125W	75042	CEAT0-7872F
R3341	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R3343	321-0081-00			RES,FXD,FILM:68.1 OHM,1%,0.125W	75042	CEAT0-68R10F
R3345	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3353	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3371	321-0081-00			RES,FXD,FILM:68.1 OHM,1%,0.125W	75042	CEAT0-68R10F
R3373	315-0132-00			RES,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R3381	315-0220-00			RES,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R3383	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3385	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3410	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R3411	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R3420	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R3431	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3450	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3451	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R3453	315-0331-00			RES,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3481	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3491	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3511	321-0216-00			RES,FXD,FILM:1.74K OHM,1%,0.125W	75042	CEAT0-1741F
R3513	315-0512-00			RES,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R3515	315-0562-00			RES,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R3517	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R3521	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3523	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3531	315-0563-00			RES,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R3541	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R3553	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R3555	315-0433-00			RES,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R3557	315-0331-00			RES,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R3581	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3583	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R3585	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3610	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R3616	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R3621	321-0343-00			RES,FXD,FILM:36.5K OHM,1%,0.125W	75042	CEAT0-3652F
R3623	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3625	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3641	321-0254-00			RES,FXD,FILM:4.32K OHM,1%,0.125W	75042	CEAT0-4321F
R3661	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3663	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3671	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R3711	321-0262-03			RES.,FXD,FILM:5.23K OHM,0.25%,0.125W	75042	CEAT2-5231C
R3713	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3791	315-0335-00			RES,FXD,CMPSN:3.3M OHM,5%,0.25W	01121	CB3355
R3793	315-0335-00			RES,FXD,CMPSN:3.3M OHM,5%,0.25W	01121	CB3355
R3795	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R3811	321-0261-00			RES,FXD,FILM:5.11K OHM,1%,0.125W	75042	CEAT0-5111F

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R3813	321-0336-00			RES,FXD,FILM:30.9 OHM,1%,0.125W	75042	CEAT0-3092F
R3814	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R3840	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3890	315-0513-00			RES,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R3911	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3913	321-0262-00			RES,FXD,FILM:5.23K OHM,1%,0.125W	75042	CEAT0-5231F
R3916	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R3961	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3993	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3995	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R3997	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4073	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R4083	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R4086	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R4096	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R4276	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4346	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R4380	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4446	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R4546	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4580	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5020	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5024	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5030	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R5037	315-0822-00			RES,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R5039	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5040	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R5045	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5048	315-0241-00			RES,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5050	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5053	315-0562-00			RES,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R5055	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5057	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R5058	315-0430-00			RES,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R5060	315-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R5062	315-0241-00			RES,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R5068	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5070	315-0113-00			RES,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R5072	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5080	315-0914-00			RES,FXD,CMPSN:DELETED	01121	CB9145
R5084	315-0274-00			RES,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5090	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5120	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R5134	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5138	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5151	315-0432-00			RES,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R5156	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R5158	321-0338-00			RES,FXD,FILM:32.4K OHM,1%,0.125W	75042	CEAT0-3242F
R5160	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5162	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5165	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5175	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5178	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935

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R5188	315-0274-00			RES,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R5190	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5198	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5224	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5226	315-0133-00			RES,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
R5228	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5240	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5242	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5245	315-0561-00			RES,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5248	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5259	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5260	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R5262	315-0561-00			RES,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R5264	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5266	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5280	315-0301-00			RES,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R5282	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5290	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5292	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5298	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R5330	321-0181-00			RES,FXD,FILM:750 OHM,1%,0.125W	75042	CEAT0-7500F
R5345	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5348	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5350	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R5352	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R5354	315-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5356	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5358	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5374	315-0623-00			RES,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
R5379	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5380	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5394	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5398	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R5412	321-0181-00			RES,FXD,FILM:750 OHM,1%,0.125W	75042	CEAT0-7500F
R5420	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5421	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5424	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5440	315-0361-00			RES,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R5459	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5460	SELECTED					
R5468	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5470	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R5472	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R5474	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5476	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5478	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5488	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5489	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5490	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5496	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5523	315-0330-00			RES,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R5525	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R5530	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225

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R5534	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5536	SELECTED					
R5538	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R5540	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R5542	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5548	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R5550	315-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R5552	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5555	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5562	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5564	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5573	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5578	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5580	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R5582	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5584	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5586	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5588	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5597	315-0201-00			RES,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R5598	315-0151-00			RES,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R5616	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R5624	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5642	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5644	315-0363-00			RES,FXD,CMPSN:36K OHM,5%,0.25W	01121	CB3635
R5646	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5662	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5664	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5666	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5669	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5670	315-0564-00			RES,FXD,CMPSN:560K OHM,5%,0.25W	01121	CB5645
R5676	315-0243-00			RES,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R5678	321-0371-00			RES,FXD,FILM:71.5K OHM,1%,0.125W	75042	CEAT0-7152F
R5682	321-0371-00			RES,FXD,FILM:71.5K OHM,1%,0.125W	75042	CEAT0-7152F
R5684	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5690	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R5697	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R5698	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R5710	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R5716	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5720	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5734	315-0753-00			RES,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R5741	315-0754-00			RES,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
R5745	315-0512-00			RES,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R5750	315-0823-00			RES,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R5751	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5753	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5762	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5774	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R5781	321-0331-00			RES,FXD,FILM:27.4K OHM,1%,0.125W	75042	CEAT0-2742F
R5782	321-0318-00			RES,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R5784	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5786	321-0318-00			RES,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R5791	315-0154-00			RES,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545

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R5793	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R5796	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W	75042	CEAT0-4992F
R5797	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5798	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5812	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5820	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R5826	315-0433-00			RES,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R5828	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R5830	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5832	315-0220-00			RES,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
R5840	315-0622-00			RES,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R5851	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R5863	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5864	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5880	315-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R5886	321-0331-00			RES,FXD,FILM:27.4K OHM,1%,0.125W	75042	CEAT0-2742F
R5896	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5898	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5910	SELECTED					
R5912	SELECTED					
R5916	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	80294	3389F-P31-502
R5918	321-0286-00			RES,FXD,FILM:9.31K OHM,1%,0.125W	75042	CEAT0-9311F
R5919	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5920	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	80294	3389F-P31-502
R5926	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R5928	315-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R5930	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5932	315-0124-00			RES,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5934	315-0124-00			RES,FXD,CMPSN:120K OHM,5%,0.25W	01121	CB1245
R5936	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R5940	321-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.125W	75042	CEAT0-1652C
R5941	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R5943	315-0333-00			RES,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R5944	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5945	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R5957	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5958	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5961	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5963	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5964	315-0475-00			RES,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
R5966	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R5968	321-0252-00			RES,FXD,FILM:4.12K OHM,1%,0.125W	75042	CEAT0-4121F
R5970	321-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.125W	75042	CEAT0-1821F
R5971	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5975	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R5976	321-0335-00			RES,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R5978	321-0705-00			RES,FXD,FILM:	75042	CEAT0-4172F
R5980	315-0474-00			RES,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R5982	321-0335-00			RES,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R5985	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R5986	321-0705-00			RES,FXD,FILM:	75042	CEAT0-4172F
R5988	321-0297-00			RES,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R5990	321-0373-00			RES,FXD,FILM:75K OHM, 1%,0.125W	75042	CEAT0-7502F

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R5992	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5994	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R5996	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R5998	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R5999	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6005	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6007	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R6008	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6071	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6075	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R6082	315-0270-00			RES,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R6083	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6086	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6098	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6108	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6117	321-0335-00			RES,FXD,FILM:30.1K OHM,1%,0.125W	75042	CEAT0-3012F
R6119	321-0314-00			RES,FXD,FILM:18.2K OHM,1%,0.125W	75042	CEAT0-1822F
R6122	321-0276-00			RES,FXD,FILM:7.32K OHM,1%,0.125W	75042	CEAT0-7321F
R6128	321-0233-00			RES,FXD,FILM:2.61K OHM,1%,0.125W	75042	CEAT0-2611F
R6132	321-0233-00			RES,FXD,FILM:2.61K OHM,1%,0.125W	75042	CEAT0-2611F
R6136	321-0240-00			RES,FXD,FILM:3.09K OHM,1%,0.125W	75042	CEAT0-3091F
R6142	321-0393-00			RES,FXD,FILM:121K OHM,1%,0.125K	75042	CEAT0-1213F
R6144	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R6148	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6152	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6154	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6158	322-0205-00			RES,FXD,FILM:1.33K OHM,1%,0.25W	75042	CEBT0-1331F
R6164	323-0176-00			RES,FXD,FILM:665 OHM,1%,0.5W	75042	CECT0-6650F
R6195	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R6202	311-1269-00			RES,VAR,NONWIR:20K OHM,10%,0.5W	73138	62PT-352-0
R6284	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6288	315-0332-00			RES,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R6304	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.5W	73138	62PT-354-0
R6314	311-1267-00			RES,VAR,NONWIR:5K OHM,10%,0.5W	73138	62PT-3500-502K
R6324	311-1267-00			RES,VAR,NONWIR:5K OHM,10%,0.5W	73138	62PT-3500-502K
R6334	311-1266-00			RES,VAR,NONWIR:2.5K OHM,10%,0.5W	73138	62PT-349-0
R6344	311-1263-00			RES,VAR,NONWW:1K OHM,10%,0.50W	73138	62PT-347-0
R6354	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.5W	73138	62PT-354-0
R6362	311-1273-00			RES,VAR,NONWIR:200K OHM,10%,0.5W	73138	62PT-356-0
R6363	315-0224-00			RES,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R6364	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6368	321-0829-07			RES,FXD,FILM:	75042	CEAT2-2020B
R6370	321-0829-07			RES,FXD,FILM:	75042	CEAT2-2020B
R6378	315-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R6384	315-0162-00			RES,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R6392	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6398	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6448	321-0130-00			RES,FXD,FILM:221 OHM,1%,0.125W	75042	CEAT0-2210F
R6463	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R6467	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R6468	315-0622-00			RES,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R6472	315-0203-00			RES,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R6474	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225

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R6504	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R6506	321-0319-00			RES,FXD,FILM:20.5K OHM,1%,0.125W	75042	CEAT0-2052F
R6508	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R6512	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R6514	321-0252-00			RES,FXD,FILM:4.12K OHM,1%,0.125W	75042	CEAT0-4121F
R6516	321-0219-00			RES,FXD,FILM:1.87K OHM,1%,0.125W	75042	CEAT0-1871F
R6518	321-0240-00			RES,FXD,FILM:3.09K OHM,1%,0.125W	75042	CEAT0-3091F
R6522	321-0182-00			RES,FXD,FILM:768 OHM,1%,0.125W	75042	CEAT0-7680F
R6524	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125K	75042	CEAT0-3571F
R6526	321-0130-00			RES,FXD,FILM:221 OHM,1%,0.125W	75042	CEAT0-2210F
R6528	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R6531	321-0319-00			RES,FXD,FILM:20.5K OHM,1%,0.125W	75042	CEAT0-2052F
R6533	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R6535	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R6537	321-0252-00			RES,FXD,FILM:4.12K OHM,1%,0.125W	75042	CEAT0-4121F
R6539	321-0219-00			RES,FXD,FILM:1.87K OHM,1%,0.125W	75042	CEAT0-1871F
R6542	321-0240-00			RES,FXD,FILM:3.09K OHM,1%,0.125W	75042	CEAT0-3091F
R6544	321-0182-00			RES,FXD,FILM:768 OHM,1%,0.125W	75042	CEAT0-7680F
R6548	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125K	75042	CEAT0-3571F
R6552	321-0155-00			RES,FXD,FILM:402 OHM,1%,0.125W	75042	CEAT0-4020F
R6562	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R6566	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R6578	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6579	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R6582	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6586	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R6612	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6614	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R6634	321-0197-00			RES,FXD,FILM:1.1K OHM,1%,0.125W	75042	CEAT0-1101F
R6638	321-0212-00			RES,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R6642	321-0235-00			RES,FXD,FILM:2.74K OHM,1%,0.125W	75042	CEAT0-2741F
R6646	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R6648	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R6663	321-0306-00			RES,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R6673	311-1265-00			RES,VAR,NONWW:TRMR,2K OHM,0.5W	80294	3329P-L58-202
R6677	321-0303-00			RES,FXD,FILM:14K OHM,1%,0.125W	75042	CEAT0-1402F
R6684	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R6687	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R6689	321-0300-00			RES,FXD,FILM:13K OHM,1%,0.125W	75042	CEAT0-1302F
R6706	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R6724	321-0291-00			RES,FXD,FILM:10.5K OHM,1%,0.125W	75042	CEAT0-1052F
R6728	321-0262-00			RES,FXD,FILM:5.23K OHM,1%,0.125W	75042	CEAT0-5231F
R6734	321-0369-00			RES,FXD,FILM:68.1K OHM,1%,0.125W	75042	CEAT0-6812F
R6736	311-1271-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	73138	62PT-354-0
R6741	311-1263-00			RES,VAR,NONWW:1K OHM,10%,0.50W	73138	62PT-347-0
R6758	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6791	321-0277-00			RES,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R6793	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6798	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W	75042	CEAT0-2431F
R6833	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R6836	311-1266-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	73138	62PT-349-0
R6842	321-0274-00			RES,FXD,FILM:6.98K OHM,1%,0.125W	75042	CEAT0-6981F
R6844	321-0238-00			RES,FXD,FILM:2.94K OHM,1%,0.125W	75042	CEAT0-2941F

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R6848	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R6859	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R6860	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R6864	308-0252-00			RES,FXD,WW:390 OHM,5%,3W	91637	RS2B-B390R0J
R6868	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R6872	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6875	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R6883	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6892	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R6898	311-1260-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	73138	62PT-345-0
R6904	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6910	321-0330-00			RES,FXD,FILM:26.7K OHM,1%,0.125W	75042	CEAT0-2672F
R6912	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W	75042	CEAT0-4021F
R6920	321-0263-00			RES,FXD,FILM5.3:5.36K OHM,1%,0.125W	75042	CEAT0-5361F
R6926	321-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.125W	75042	CEAT0-1652C
R6938	311-1269-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	73138	62PT-352-0
R6942	311-1263-00			RES,VAR,NONWW:1K OHM,10%,0.50W	73138	62PT-347-0
R6944	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	75042	CEAT0-49R90F
R6956	315-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R6977	311-1260-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	73138	62PT-345-0
R6981	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R6983	321-0277-00			RES,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R6992	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R6996	321-0277-00			RES,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R7005	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7030	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R7034	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R7131	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80294	3389F-P31-103
R7138	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80294	3389F-P31-103
R7143	311-1263-00			RES,VAR,NONWW:1K OHM,10%,0.50W	73138	62PT-347-0
R7181	315-0203-00			RES,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R7215	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R7236	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R7237	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R7238	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7240	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7241	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R7331	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7333	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7341	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7361	311-0613-00			RES,VAR,NONWW:TRMR,100K OHM,0.5W	80740	62-63-3
R7371	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7381	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7383	315-0474-00			RES,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R7385	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R7441	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7443	315-0240-00			RES,FXD,CMPSN:24 OHM,5%,0.25W	01121	CB2405
R7445	321-0309-00			RES,FXD,FILM:16.2K OHM,1%,0.125W	75042	CEAT0-1622F
R7452	SELECTED					
R7453	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	80294	3389F-P31-502
R7461	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125W	75042	CEAT0-3571F
R7490	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R7491	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525

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R7492	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7542	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R7544	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R7551	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125W	75042	CEAT0-3571F
R7553	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125W	75042	CEAT0-3571F
R7554	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7555	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R7561	311-1223-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	80294	3386F-T04-251
R7564	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R7571	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R7575	SELECTED					
R7581	321-0246-00			RES,FXD,FILM:3.57K OHM,1%,0.125W	75042	CEAT0-3571F
R7583	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R7590	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R7591	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R7615	311-0605-00			RES,VAR,NONWW:TRMR,200 OHM,0.5W	80740	62-54-3
R7632	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W	75042	CEAT0-2431F
R7634	321-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.125W	75042	CEAT0-1821F
R7660	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7661	311-0634-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80740	62-55-3
R7685	321-0172-00			RES,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R7691	321-0224-00			RES,FXD,FILM:2.1K OHM,1%,0.125W	75042	CEAT0-2101F
R7711	321-0168-00			RES,FXD,FILM:549 OHM,1%,0.125W	75042	CEAT0-5490F
R7721	321-0101-00			RES,FXD,FILM:110 OHM,1%,0.125W	75042	CEAT0-1100F
R7723	321-0172-00			RES,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R7725	321-0097-00			RES,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R7727	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R7729	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R7731	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R7733	311-1224-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80294	3389F-P31-501
R7735	311-1222-00			RES,VAR,NONWW:TRMR,100 OHM,0.5W	80294	3386F-T04-500
R7751	321-0272-00			RES,FXD,FILM:6.65K OHM,1%,0.125W	75042	CEAT0-6651F
R7753	321-0159-00			RES,FXD,FILM:442 OHM,1%,0.125W	75042	CEAT0-4420F
R7761	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R7763	315-0911-00			RES,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R7771	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R7841	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R7843	321-0191-00			RES,FXD,FILM:953 OHM,1%,0.125W	75042	CEAT0-9530F
R7851	321-0222-00			RES,FXD,FILM:2K OHM,1%,0.125W	75042	CEAT0-2001F
R7853	308-0252-00			RES,FXD,WW:390 OHM,5%,3W	91637	RS2B-B390R0J
R7891	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7893	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R7901	315-0681-00			RES,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
R7911	315-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R7912	315-0221-00			RES,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R7913	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R7915	321-0210-00			RES,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R7921	308-0252-00			RES,FXD,WW:390 OHM,5%,3W	91637	RS2B-B390R0J
R7923	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B
R7931	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B
R7933	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B
R7935	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B
R7941	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B

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R7943	321-0114-07			RES,FXD,FILM:150 OHM,0.1%,0.125W	75042	CEAT9-1500B
R7951	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R7953	301-0821-00			RES,FXD,CMPSN:820 OHM,5%,0.50W	01121	EB8215
R7955	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R7961	321-0105-00			RES,FXD,FILM:121 OHM,1%,0.125W	75042	CEAT0-1210F
R7963	321-0097-00			RES,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R7971	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R7973	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	75042	CEAT0-49R90F
R7981	321-0239-00			RES,FXD,FILM:3.01K OHM,1%,0.125W	75042	CEAT0-3011F
R7983	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	75042	CEAT0-49R90F
R7991	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R7993	311-1221-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	80294	3389F-P31-500
R7995	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8009	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8049	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R8057	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R8068	321-0258-00			RES,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R8088	321-0361-00			RES,FXD,FILM:56.2K OHM,1%,0.125W	75042	CEAT0-5622F
R8118	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8143	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8145	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8163	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8165	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8171	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R8172	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80294	3389F-P31-103
R8185	321-0332-00			RES,FXD,FILM:28K OHM,1%,0.125W	75042	CEAT0-2802F
R8230	315-0911-00			RES,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R8242	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8262	315-0222-00			RES,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R8272	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	80294	3389F-P31-203
R8284	321-0361-00			RES,FXD,FILM:56.2K OHM,1%,0.125W	75042	CEAT0-5622F
R8285	321-0332-00			RES,FXD,FILM:28K OHM,1%,0.125W	75042	CEAT0-2802F
R8287	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R8320	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8334	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R8335	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R8338	315-0122-00			RES,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R8358	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R8360	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R8366	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R8376	315-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R8378	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8380	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8381	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R8431	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	80294	3389F-P31-103
R8466	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8474	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8494	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R8522	321-0328-00			RES,FXD,FILM:25.5K OHM,1%,0.125W	75042	CEAT0-2552F
R8552	315-0512-00			RES,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8554	315-0512-00			RES,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R8556	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8572	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R8576	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8578	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8621	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R8656	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8658	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8659	315-0302-00			RES,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R8671	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8676	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8690	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R8752	321-0154-00			RES,FXD,FILM:392 OHM,1%,0.125W	75042	CEAT0-3920F
R8754	321-0154-00			RES,FXD,FILM:392 OHM,1%,0.125W	75042	CEAT0-3920F
R8783	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8834	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R8836	321-0306-00			RES,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R8838	321-0314-00			RES,FXD,FILM:18.2K OHM,1%,0.125W	75042	CEAT0-1822F
R8852	321-0187-00			RES,FXD,FILM:866 OHM,1%,0.125W	75042	CEAT0-8660F
R8864	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8870	311-1224-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80294	3389F-P31-501
R8881	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R8884	315-0181-00			RES,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R8886	321-0306-00			RES,FXD,FILM:15K OHM,1%,0.125W	75042	CEAT0-1502F
R8888	315-0202-00			RES,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R8889	321-0812-07			RES,FXD,FILM:455 OHM,0.1%,0.125W	75042	CEAT9-4550B
R8896	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8898	315-0470-00			RES,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R8906	315-0100-00			RES,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R8917	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8920	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	80294	3389F-P31-502
R8934	321-0314-00			RES,FXD,FILM:18.2K OHM,1%,0.125W	75042	CEAT0-1822F
R8938	321-0289-00			RES,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R8955	315-0271-00			RES,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R8974	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R8980	321-0812-07			RES,FXD,FILM:455 OHM,0.1%,0.125W	75042	CEAT9-4550B
R8982	321-0215-00			RES,FXD,FILM:1.69K OHM,1%,0.125W	75042	CEAT0-1691F
R8984	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W	75042	CEAT0-2431F
R8986	321-0215-00			RES,FXD,FILM:1.69K OHM,1%,0.125W	75042	CEAT0-1691F
R8988	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W	75042	CEAT0-2431F
R8990	311-1222-00			RES,VAR,NONWW:TRMR,100 OHM,0.5W	80294	3386F-T04-500
R9080	302-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.50W	01121	EB1021
R9082	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9205	311-1182-00			RES,VAR,NONWW:PNL,1.5K OHM,0.5W	01121	W7835
R9209	311-1095-00			RES,VAR,NONWW:PNL,10K OHM,0.5W	11237	300SF-3P1631
R9210	311-0585-00			RES,VAR,NONWW:PNL,15K OHM,0.25W	71590	BA147-042
R9212	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R9215	311-0310-00			RES,VAR,NONWW:PNL,5K OHM,0.5W	01121	W-7350A
R9223	315-0103-00			RES,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R9225	311-1095-00			RES,VAR,NONWW:PNL,10K OHM,0.5W	11237	300SF-3P1631
R9230	321-0265-00			RES,FXD,FILM:5.62K OHM,1%,0.125W	75042	CEAT0-5621F
R9231	321-0295-00			RES,FXD,FILM:11.5K OHM,1%,0.125W	75042	CEAT0-1152F
R9232	321-0287-00			RES,FXD,FILM:9.53K OHM,1%,0.125W	75042	CEAT0-9531F
R9233	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W	75042	CEAT0-8251F
R9234	321-0272-00			RES,FXD,FILM:6.65K OHM,1%,0.125W	75042	CEAT0-6651F
R9235	321-0264-00			RES,FXD,FILM:5.49K OHM,1%,0.125W	75042	CEAT0-5491F

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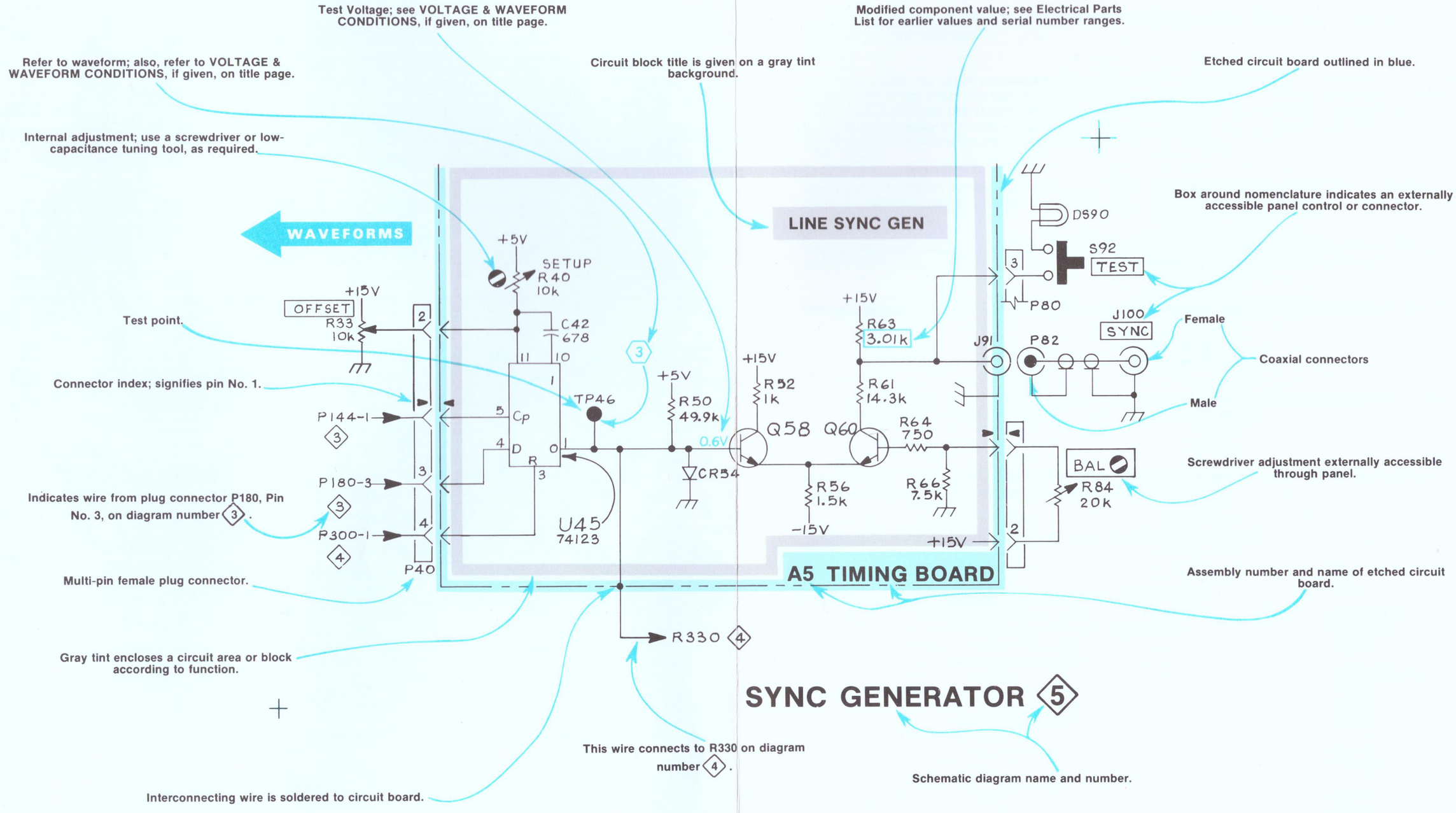
R9236	321-0257-00			RES,FXD,FILM:4.64K OHM,1%,0.125W	75042	CEAT0-4641F
R9237	321-0249-00			RES,FXD,FILM:3.83K OHM,1%,0.125W	75042	CEAT0-3831F
R9238	321-0244-00			RES,FXD,FILM:3.4K OHM,1%,0.125W	75042	CEAT0-3401F
R9239	321-0241-00			RES,FXD,FILM:3.16K OHM,1%,0.125W	75042	CEAT0-3161F
R9280	311-0361-00			RES,VAR,NONWW:PNL,500K OHM,0.5W	01121	W7684
R9285	311-0449-00			RES.,VAR,WW:1.5K OHM,5%,1.5W	01121	GA1G024S152MA
R9290	311-0326-00			RES,VAR,NONWW:PNL,10K OHM,0.5W	01121	W7683
R9291	321-1170-03			RES,FXD,FILM583:583 OHM,0.25%,0.125W	91637	MFF1816D583R0C
R9292	321-0180-03			RES,FXD,FILM:732 OHM,0.25%,0.125W	91637	MFF1816D732R0C
R9293	321-0190-03			RES,FXD,FILM:931 OHM,0.25%,0.125W	91637	MFF1816D931R0C
R9294	321-0202-03			RES,FXD,FILM:1.24K OHM,0.25W,0.125W	91637	MFF1816D12400C
R9295	321-1216-03			RES,FXD,FILM1.7:1.76K OHM,0.25W,0.125W	91637	MFF1816D1761R0C
R9296	321-0233-03			RES,FXD,FILM:	91637	MFF1816D26100C
R9297	321-1254-03			RES,FXD,FILM4.3:4.37K OHM,0.25%,0.125W	91637	MFF1816D43700C
R9298	321-1283-03			RES,FXD,FILM8.7:8.76K OHM,0.25%,0.125W	91637	MFF1816D87600C
R9299	321-1329-03			RES,FXD,FILM26.:	91637	MFF1816D26401C
R9619	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9623	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R9625	321-0326-00			RES,FXD,FILM:24.3K OHM,1%,0.125W	75042	CEAT0-2432F
R9672	311-1261-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	80294	3329P-L58-501
R9674	321-0318-00			RES,FXD,FILM:20K OHM,1%,0.125W	75042	CEAT0-2002F
R9683	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R9685	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9686	315-0102-00			RES,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R9688	321-0295-00			RES,FXD,FILM:11.5K OHM,1%,0.125W	75042	CEAT0-1152F
R9690	315-0203-00			RES,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R9702	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R9704	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9706	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9708	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R9712	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R9716	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9718	315-0153-00			RES,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R9721	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R9723	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R9728	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9731	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R9732	315-0362-00			RES,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R9733	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R9738	315-0184-00			RES,FXD,CMPSN:180K OHM,5%,0.25W	01121	CB1845
R9739	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9741	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R9746	315-0272-00			RES,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R9747	315-0393-00			RES,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R9748	315-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R9754	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R9755	315-0183-00			RES,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
R9758	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9763	315-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R9764	315-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R9768	315-0224-00			RES,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
R9796	315-0473-00			RES,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R9797	315-0563-00			RES,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R9800	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9801	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R9802	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9803	301-0510-00			RES,FXD,CMPSN:51 OHM,5%,0.50W	01121	EB5105
R9804	308-0590-00			RES,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-R250J
R9806	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9808	321-0197-00			RES,FXD,FILM:1.1K OHM,1%,0.125W	75042	CEAT0-1101F
R9810	321-0189-00			RES,FXD,FILM:909 OHM,1%,0.125W	75042	CEAT0-9090F
R9812	315-0752-00			RES,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R9814	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9816	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9818	315-0751-00			RES,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R9830	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9831	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R9832	308-0499-00			RES.,FXD,WW:0.5 OHM,10%,2.5W AXIAL	91637	RS2B-ER5000K
R9834	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9836	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9838	321-0224-00			RES,FXD,FILM:2.1K OHM,1%,0.125W	75042	CEAT0-2101F
R9840	321-0189-00			RES,FXD,FILM:909 OHM,1%,0.125W	75042	CEAT0-9090F
R9842	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9844	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9846	315-0301-00			RES,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9848	315-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R9850	315-0152-00			RES,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R9851	311-1268-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	62PT-351-0
R9852	315-0431-00			RES,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R9854	321-0172-00			RES,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R9856	321-0189-00			RES,FXD,FILM:909 OHM,1%,0.125W	75042	CEAT0-9090F
R9858	321-0173-00			RES,FXD,FILM:619 OHM,1%,0.125W	75042	CEAT0-6190F
R9860	315-0471-00			RES,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R9862	315-0301-00			RES,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R9864	315-0472-00			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R9866	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9868	315-0101-00			RES,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R9870	315-0331-00			RES,FXD,CMPSN:330 OHM,5%,0.25W	01121	CB3315
R9872	315-0392-00			RES,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R9874	308-0499-00			RES.,FXD,WW:0.5 OHM,10%,2.5W AXIAL	91637	RS2B-ER5000K
S9201	260-0834-00			SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD	09353	7201-SN
S9202[1]						
S9203[1]						
S9205	260-0731-00			SWITCH,LEVER:	80009	260-0731-00
S9212	260-1375-00			SWITCH,LEVER:	80009	260-1375-00
S9213	260-1390-00			SWITCH,LEVER:	80009	260-1390-00
S9225	260-0731-00			SWITCH,LEVER:	80009	260-0731-00
S9230	260-0621-00			SWITCH,LEVER:	80009	260-0621-00
S9235	260-1252-00			SWITCH,ROTARY:	80009	260-1252-00
S9240	262-0976-00			SWITCH,WIRED:	80009	262-0976-00
S9240	260-1251-00			SWITCH,ROTARY:	80009	260-1251-00
S9250	260-1383-00			SWITCH,LEVER:	80009	260-1383-00
S9253	260-0621-00			SWITCH,LEVER:	80009	260-0621-00
S9255	260-1376-00			SWITCH,LEVER:	80009	260-1376-00
S9260	260-1250-00			SWITCH,ROTARY:	76854	5-12191-411

[1]See MPL Line Voltage Selector Body.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
S9265	260-1388-00			SWITCH,ROTARY:	76854	5-11771-410
S9275	260-1389-00			SWITCH,LEVER:	80009	260-1389-00
S9280	260-0621-00			SWITCH,LEVER:	80009	260-0621-00
S9285	260-0621-00			SWITCH,LEVER:	80009	260-0621-00
S9290	262-0975-00			SWITCH,WIRED:	80009	262-0975-00
S9290	260-1374-00			SWITCH,ROTARY:	80009	260-1374-00
S9300	260-0731-00			SWITCH,LEVER:	80009	260-0731-00
S9320	260-0731-00			SWITCH,LEVER:	80009	260-0731-00
T9001	120-0737-00			XFMR,PWR,STPDN:	80009	120-0737-00
U101	156-0043-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN7402N
U201	156-0114-00			MICROCKT,DGTL:	07263	U6A749259X
U301	156-0072-00			MICROCKT,LINEAR:MONOSTABLE MV,TTL	12040	DM74121N
U321	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U339	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U359	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U430	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U450	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U470	156-0037-00			MICROCKT,DGTL:	01295	SN7451N
U761	155-0022-00			MICROCKT,DGTL:ML,CHANNEL SWITCH	80009	155-0022-00
U861	155-0022-00			MICROCKT,DGTL:ML,CHANNEL SWITCH	80009	155-0022-00
U1001	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U1031	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U1061	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1091	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1101	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U1131	156-0034-00			MICROCKT,DGTL:DUAL 4-INP POS NAND GATE	01295	SN7420N
U1161	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1181	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U1191	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1201	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U1231	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U1261	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U1281	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1291	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1301	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U1331	156-0034-00			MICROCKT,DGTL:DUAL 4-INP POS NAND GATE	01295	SN7420N
U1361	156-0248-00			MICROCKT,DGTL:	01295	SN74163N
U1391	156-0248-00			MICROCKT,DGTL:	01295	SN74163N
U1431	156-0323-00			MICROCKT,DGTL:	01295	SN74S04N
U1461	156-0047-00			MICROCKT,DGTL:TPL 3-INP NAND GATE	01295	SN7410N
U2001	156-0078-00			MICROCKT,DGTL:	01295	SN74154N
U2061	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2081	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2261	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2281	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2401	156-0078-00			MICROCKT,DGTL:	01295	SN74154N
U2461	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2481	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2661	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2681	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2721	156-0037-00			MICROCKT,DGTL:	01295	SN7451N
U2741	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U2761	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2781	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2811	156-0072-00			MICROCKT,LINEAR:MONOSTABLE MV,TTL	12040	DM74121N
U2831	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U2861	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U2881	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2911	156-0057-00			MICROCKT,DGTL:QUAD 2-INP NAND GATE OC	07263	9N01PC
U2931	156-0058-00			MICROCKT,DGTL:HEX INVERTER	04713	MC7404P
U2961	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2981	156-0057-00			MICROCKT,DGTL:QUAD 2-INP NAND GATE OC	07263	9N01PC
U3100	156-0048-00			MICROCKT,LIN:5 XSTR ARRAY RCA3046 14	86684	CA3046
U3585	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U3735	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U3755	156-0058-00			MICROCKT,DGTL:HEX INVERTER	04713	MC7404P
U3775	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U3835	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U3855	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U3875	156-0043-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN7402N
U4151	156-0032-00			MICROCKT,DGTL:4-B BIN CNTR	01295	SN7493AN
U4281	156-0043-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN7402N
U4351	156-0078-00			MICROCKT,DGTL:	01295	SN74154N
U4381	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4481	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4551	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4581	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4621	156-0043-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN7402N
U4641	156-0043-00			MICROCKT,DGTL:QUAD 2-INP NOR GATE	01295	SN7402N
U4651	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4681	156-0037-00			MICROCKT,DGTL:	01295	SN7451N
U4721	156-0058-00			MICROCKT,DGTL:HEX INVERTER	04713	MC7404P
U4741	156-0058-00			MICROCKT,DGTL:HEX INVERTER	04713	MC7404P
U4751	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4781	156-0037-00			MICROCKT,DGTL:	01295	SN7451N
U4821	156-0035-00			MICROCKT,DGTL:8-INP POS NAND GATE	01295	SN7430N
U4841	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4851	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U4881	156-0037-00			MICROCKT,DGTL:	01295	SN7451N
U5921	156-0172-00			MICROCKT,DGTL:DUAL MONOSTABLE MV	01295	SN74123N
U5967	156-0057-00			MICROCKT,DGTL:QUAD 2-INP NAND GATE OC	07263	9N01PC
U6170	156-0048-00			MICROCKT,LIN:5 XSTR ARRAY RCA3046 14	86684	CA3046
U7291	156-0067-00			MICROCKT,LINEAR:OPNL AMPL	80009	156-0067-00
U8110	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U8620	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U8720	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
U8820	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U8890	156-0130-00			MICROCKT,LINEAR:BALANCED MODEM	04713	MC1496G
U9601	156-0030-00			MICROCKT,DGTL:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U9678	156-0067-00			MICROCKT,LINEAR:OPNL AMPL	80009	156-0067-00
U9694	156-0041-00			MICROCKT,DGTL:DUAL D FF	27014	DM7474N
VR6484	152-0226-00			SEMICOND DVC,DI:ZENER,0.4W,5.1V,5%	81483	69-6584
VR9850	152-0212-00			SEMICOND DVC,DI:ZENER,0.5W,9V,5%	04713	SZ50646
Y5730	158-0080-00			XTAL UNIT,QTZ:3.575611MHZ 0.0035%, SERIES	80009	158-0080-00


Test Voltage; see VOLTAGE & WAVEFORM CONDITIONS, if given, on title page.
Modified component value; see Electrical Parts List for earlier values and serial number ranges.
Refer to waveform; also, refer to VOLTAGE & WAVEFORM CONDITIONS, if given, on title page.
Circuit block title is given on a gray tint background.
Etched circuit board outlined in blue.
Internal adjustment; use a screwdriver or low-capacitance tuning tool, as required.
Box around nomenclature indicates an externally accessible panel control or connector.
WAVEFORMS
LINE SYNC GEN
+5V
SETUP
R40
10k
+15V
OFFSET
R33
10k
C42
678
Test point.
Connector index; signifies pin No. 1.
TP46
R50
49.9k
+15V
R52
1k
R63
3.01k
R61
14.3k
D590
S92
TEST
P80
J100
SYNC
Female
Coaxial connectors
Male
J91
P82
P144-1
3
Cp
D
R
0
Q58
Q60
R64
750
0.6V
CR54
R56
1.5k
R66
7.5k
BAL
R84
20k
Screwdriver adjustment externally accessible through panel.
P180-3
P300-1
4
P40
U45
74123
-15V
+15V
Indicates wire from plug connector P180, Pin No. 3, on diagram number 3.
A5 TIMING BOARD
Multi-pin female plug connector.
Assembly number and name of etched circuit board.
R330 4
Gray tint encloses a circuit area or block according to function.
SYNC GENERATOR 5
This wire connects to R330 on diagram number 4.
Schematic diagram name and number.
Interconnecting wire is soldered to circuit board.

1813-43

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

This section of the manual contains block and schematic diagrams with waveforms and etched circuit board illustrations.

Symbols

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971. Logic symbology is based on ANSI Y32.14-1973 (IEEE Std. 91-1973). Logic symbols depict the logic function performed and may differ from the manufacturer's data.

Component Values

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in micofarads (μF).

Resistors = Ohms (Ω).

Semiconductor Types

Refer to the Electrical Parts List.

Reference Designators

The following letters are used as reference designators to identify components or assemblies on Tektronix, Inc. schematic diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DH	Decoupling Hybrid
DL	Delay Line
DS	Indicating device (lamp)
E, SG	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
P	Connector, movable portion
Q	Transistor, silicon-controlled rectifier, or programmable unijunction transistor
R	Resistor, fixed or variable
RT	Thermistors
S	Switch
T	Transformer
TC	Thermocouple
TP	Test Point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

Partial Schematic Diagram With Explanations

The partial diagram at the left is an example of the various symbols and other information provided on Tektronix, Inc. diagrams.

Transformer Wiring

A two-letter abbreviation color code is used to identify wires without terminal connection labels.

Bk	Black
Br	Brown
Rd	Red
Or	Orange
Yl	Yellow
G	Green
Bl	Blue
Vi	Violet
Gy	Gray
W	White

VOLTAGE AND WAVEFORM CONDITIONS

Circuit voltages measured with a 20,000 Ω/volt VOM; all readings in volts. Voltages are measured with respect to chassis ground unless noted otherwise.

Waveforms shown are actual photographs taken with a TEKTRONIX Oscilloscope Camera System. Test oscilloscope deflection factor and sweep rate conditions are noted on each waveform. DC coupling was used to obtain the DC levels that are recorded at the right side of each waveform. These DC levels are located with respect to the graticule rather than to the waveform. To indicate time relationship between signals, the test oscilloscope was triggered externally, where possible. The triggering source, except where noted was the 145-M Comp Sync output.

Voltages and Waveforms on the diagram (shown in blue) are not absolute and may vary between instruments because of differing component tolerances, internal calibration, etc.

The test oscilloscope used for obtaining the waveform photographs had the following minimum characteristics: Deflection factor, 1 mV/Div (10 mV/Div with a 10X probe); frequency response, DC to 10 MHz; sweep rates, 0.05 μs/Div to 5 ms/Div.

Delayed sweep and delaying sweep are both displayed. The Delay Time Multiplier (DTM) setting is noted on each waveform.

WARNING

"Coaxial shields and ground lugs" are not always at ground potential. Check the diagram before using such connections as a ground for the VOM or test oscilloscope probe.

A TEKTRONIX Type 145-M PAL-M TEST SIGNAL GENERATOR was used to provide an external 1 volt peak to peak composite video signal to the 148-M PROGRAM INPUT 75 Ω.

Unless noted otherwise on each diagram, the 148-M switches were set as follows:

POWER	ON
SYNC	INT
INSERTION SIGNAL CONTROL	
UNITY GAIN/VAR	UNITY GAIN
PROGRAM/PREVIEW/AUXILIARY	PROGRAM
LOCAL/REMOTE	LOCAL
NOISE AND PEDESTAL	
NOISE	DELETION (Full Line)
PEDESTAL	700 mV
NOISE LEVEL dB	−20 dB
MULTIBURST AMPLITUDE	700 mV
LINEARITY	
SUBCARRIER	140 mV
Mode	10 STEPS
FULL FIELD SIG	
Selector	CCIR-I
BURST	NORM
Mode	ALL LINES
APL	FIELD SQ WAVE

The 148-M OUTPUTS were all terminated with 75 Ω.

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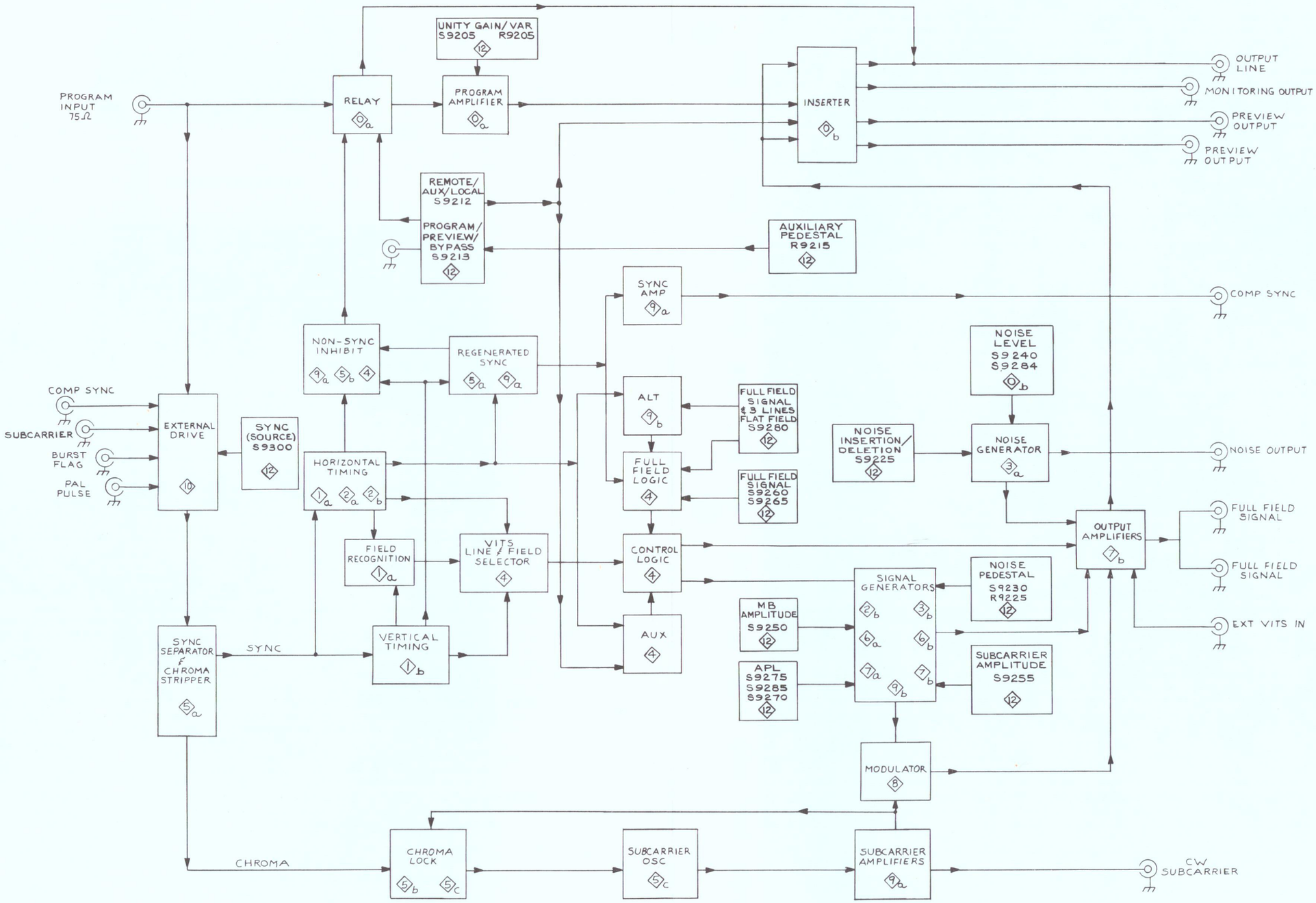
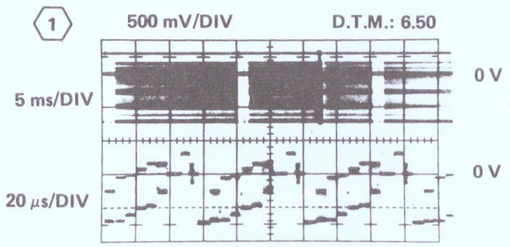
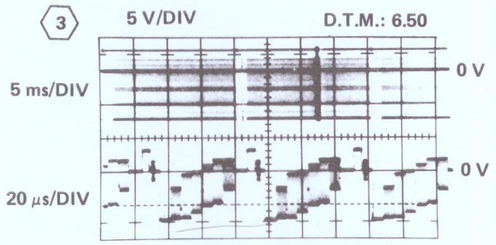
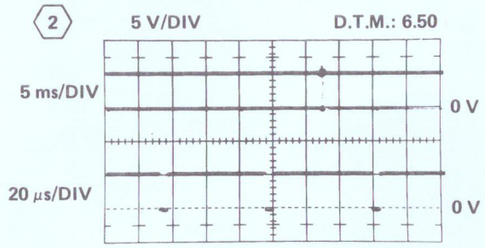
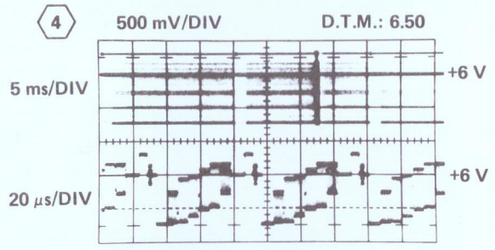

UNITY GAIN/VAR S9205 R9205 12
PROGRAM INPUT 75Ω
RELAY 0a
PROGRAM AMPLIFIER 0a
INSERTER 0b
OUTPUT LINE
MONITORING OUTPUT
PREVIEW OUTPUT
PREVIEW OUTPUT
REMOTE/AUX/LOCAL S9212
PROGRAM/PREVIEW/BYPASS S9213 12
AUXILIARY PEDESTAL R9215 12
SYNC AMP 9a
COMP SYNC
NOISE LEVEL S9240 S9284 0b
NON-SYNC INHIBIT 9a 5b 4
REGENERATED SYNC 5a 9a
COMP SYNC
SUBCARRIER
BURST FLAG
PAL PULSE
EXTERNAL DRIVE 10
SYNC (SOURCE) S9300 12
HORIZONTAL TIMING 1a 2a 2b
ALT 9b
FULL FIELD SIGNAL & 3 LINES FLAT FIELD S9280 12
FULL FIELD LOGIC 4
FULL FIELD SIGNAL S9260 S9265 12
NOISE INSERTION/DELETION S9225 12
NOISE GENERATOR 3a
NOISE OUTPUT
OUTPUT AMPLIFIERS 7b
FULL FIELD SIGNAL
FULL FIELD SIGNAL
FIELD RECOGNITION 1a
VITS LINE & FIELD SELECTOR 4
CONTROL LOGIC 4
NOISE PEDESTAL S9230 R9225 12
SIGNAL GENERATORS 2b 3b 6a 6b 7a 7b 9b
MB AMPLITUDE S9250 12
AUX 4
EXT VITS IN
APL S9275 S9285 S9270 12
SUBCARRIER AMPLITUDE S9255 12
SYNC SEPARATOR & CHROMA STRIPPER 5a
SYNC
VERTICAL TIMING 1b
MODULATOR 8
CHROMA
CHROMA LOCK 5b 5c
SUBCARRIER OSC 5c
SUBCARRIER AMPLIFIERS 9a
CW SUBCARRIER

◇0 a









Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.

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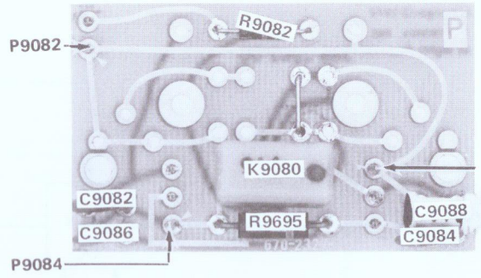
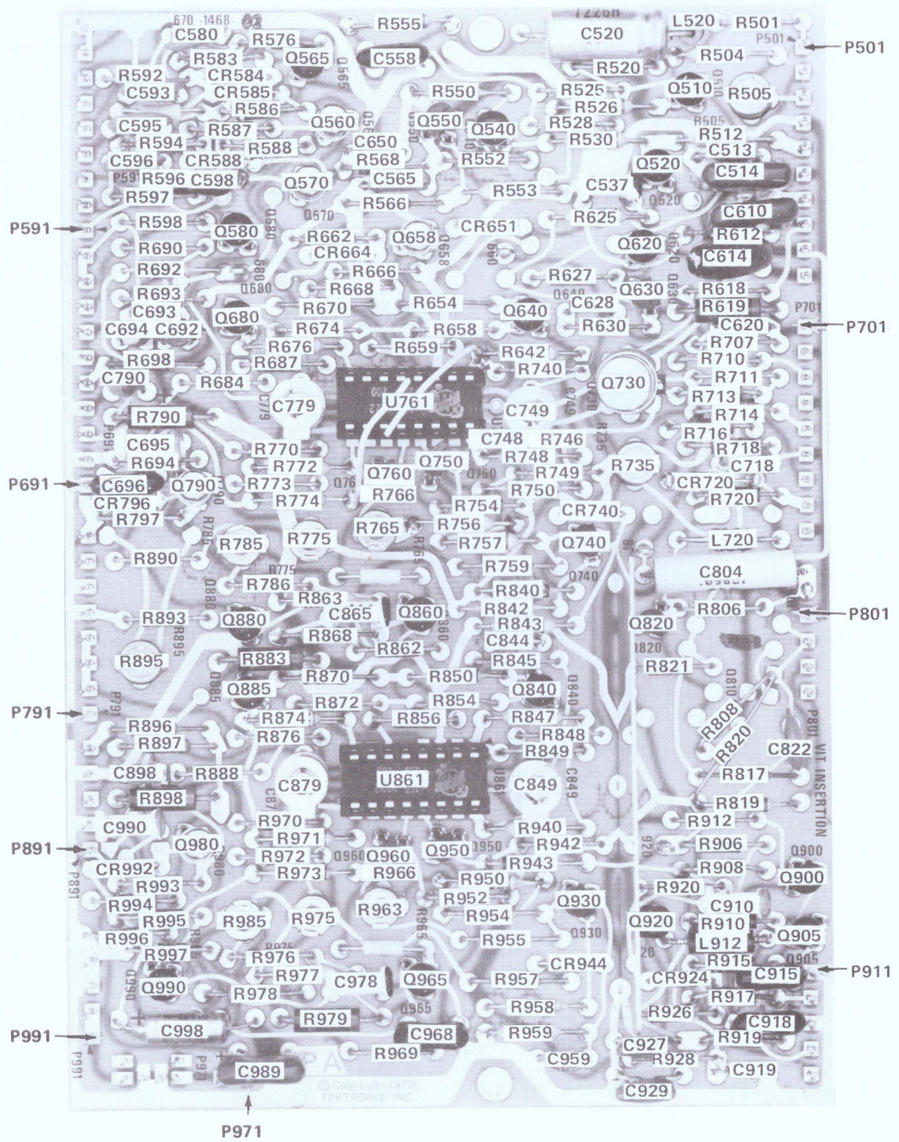


A13 RELAY BOARD



A0 VITS INSERTION BOARD

PROGRAM LINE AMPLIFIER

BYPASS INDICATOR

C693

Q580

R598
R690
R693
R817
R819

PROGRAM AMPLIFIER

C520
C537
C558
C565
C620

C628
C650
C718
C804

CR720

L520

Q510
Q520
Q540
Q550
Q620
Q630

R501
R504
R505
R512
R520

R525
R526
R528
R530
R550

R552
R553
R555
R562
R566

R612
R619
R625
R627
R628

R630
R707
R716
R718
R720
R735

TP660
TP820

OFF BOARD COMPONENTS

C9215
C9218

J9002
J9009
J9210

R9205
R9212
R9215

S9212
S9213

RELAY BOARD

C9082
C9084
C9086
C9088

K9080

R9080

BACK PORCH CLAMP

L720

Q820

R806
R808
R906

TP801

BACK PORCH

C822
C910
C915
C918
C919
C927
C929

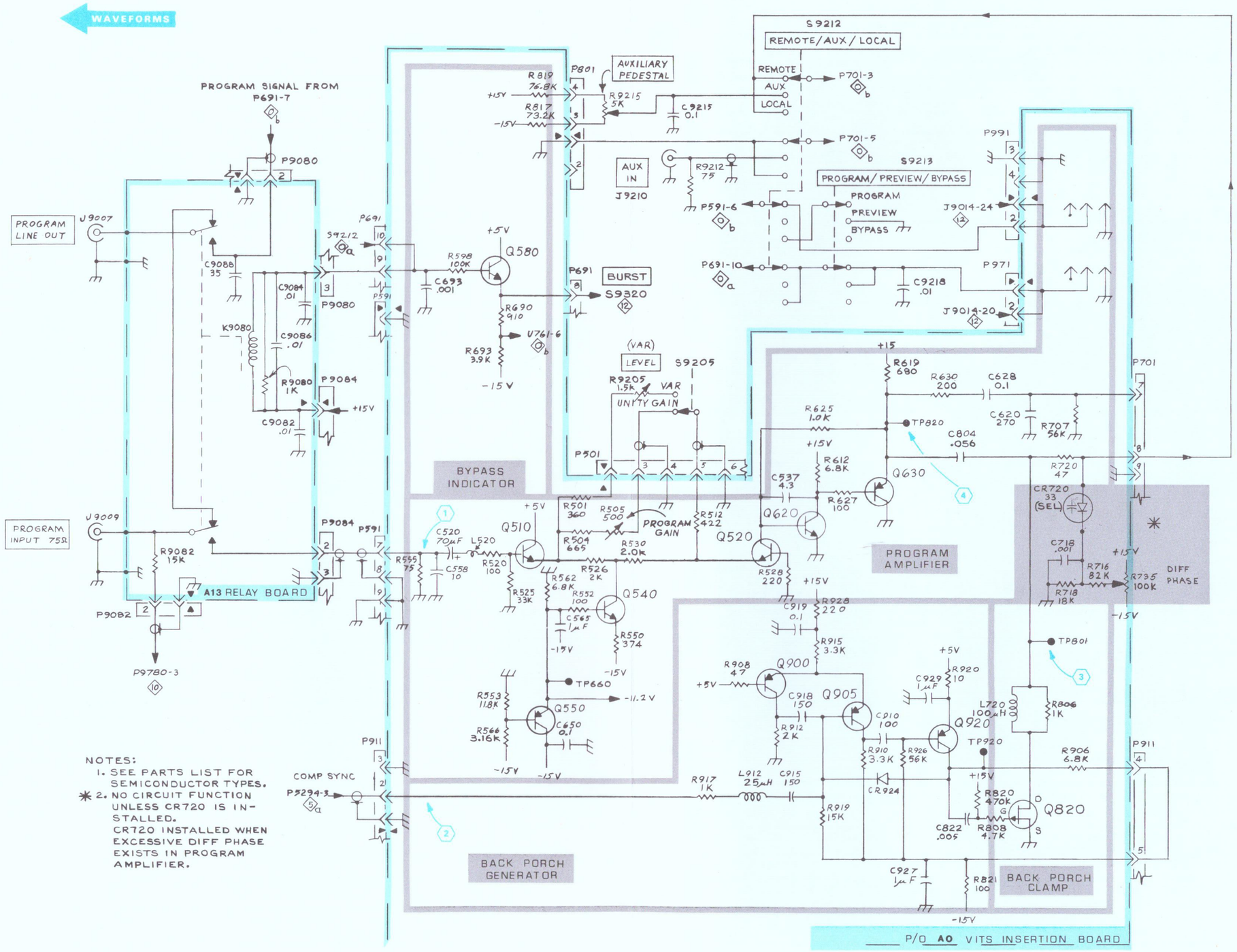
CR924

L912

R820
R821
R908
R910
R912

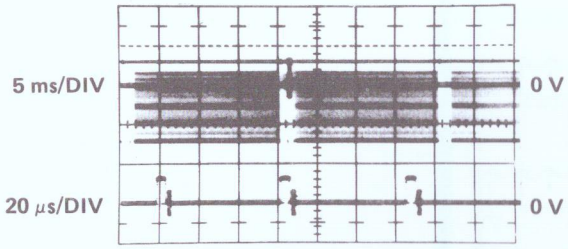
R915
R917
R919
R920
R926
R928

TP920

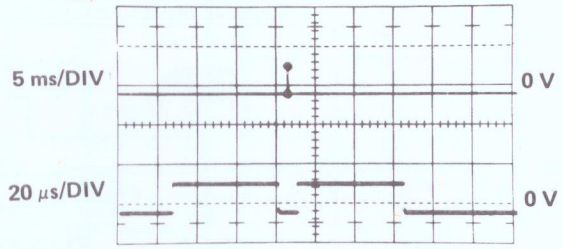

PROGRAM SIGNAL FROM P691-7
PROGRAM LINE OUT
J9007
P9080
C9088 35
C9084 .01
C9086 .01
K9080
R9080 1K
C9082 .01
P9084
+15V
PROGRAM INPUT 75Ω
J9009
R9082 15K
A13 RELAY BOARD
P9082
P9780-3
P591
P691
S9212
R598 100K
C693 .001
+5V
Q580
R690 910
R693 3.9K
U761-6
-15 V
P691
BURST
S9320
AUXILIARY PEDESTAL
P801
R819 76.8K
R817 73.2K
R9215 5K
C9215 0.1
AUX IN J9210
R9212 75
P591-6
P691-10
S9212
REMOTE/AUX/LOCAL
REMOTE
AUX
LOCAL
P701-3
P701-5
S9213
PROGRAM/PREVIEW/BYPASS
PROGRAM
PREVIEW
BYPASS
P991
J9014-24
P971
J9014-20
C9218 .01
(VAR) LEVEL
S9205
R9205 1.5k
VAR UNITY GAIN
P501
BYPASS INDICATOR
+15
R619 680
R630 200
C628 0.1
C620 270
R707 56K
P701
TP820
C804 .056
R625 1.0K
+15V
R612 6.8K
C537 4.3
R627 100
Q630
R720 47
CR720 33 (SEL)
C718 .001
R716 82K
R718 18K
R735 100K
DIFF PHASE
+5V
Q510
R501 360
R505 500
PROGRAM GAIN
R504 665
R530 2.0K
R512 422
Q520
Q620
R528 220
PROGRAM AMPLIFIER
C520 70μF
L520
R520 100
R525 33K
R562 6.8K
R552 100
Q540
C565 1μF
R550 374
R555 75
C558 10
TP660
-11.2 V
R553 11.8K
R566 3.16K
Q550
C650 0.1
C919 0.1
R928 220
R915 3.3K
R908 4.7
Q900
C918 150
Q905
C910 100
R912 2K
R910 3.3K
R926 56K
Q920
TP920
L720 100μH
R806 1K
TP801
C929 1μF
R920 10
R906 6.8K
P911
COMP SYNC
P5294-3
R917 1K
L912 25μH
C915 150
CR924
R919 15K
R820 470K
R808 4.7K
Q820
C822 .005
C927 1μF
R821 100
BACK PORCH CLAMP
BACK PORCH GENERATOR
P/O A0 VITS INSERTION BOARD
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
* 2. NO CIRCUIT FUNCTION UNLESS CR720 IS INSTALLED.
CR720 INSTALLED WHEN EXCESSIVE DIFF PHASE EXISTS IN PROGRAM AMPLIFIER.

0 b

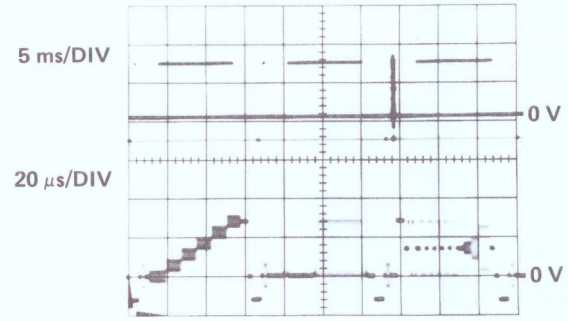
1 .5V/DIV D.T.M.: 6.75



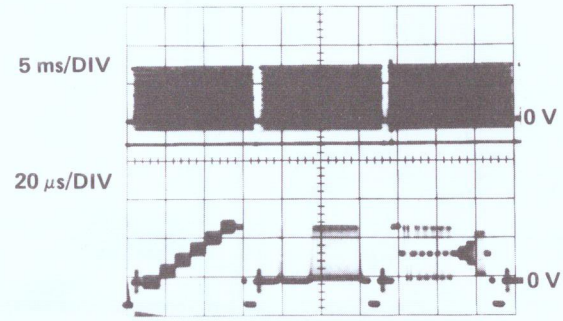
3 .5V/DIV D.T.M.: 6.75



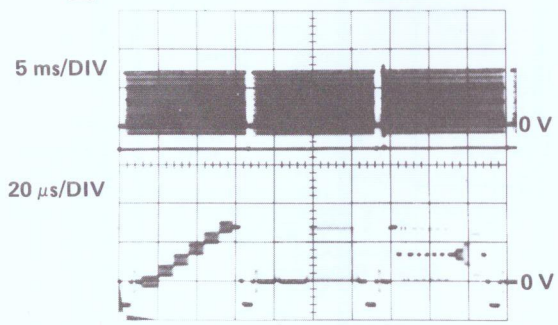
2 .5V/DIV D.T.M.: 6.75



4 .5V/DIV D.T.M.: 6.75



5 .5V/DIV D.T.M.: 6.75



Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.

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VITS INSERTER

◇0 b

PREVIEW INDICATOR

C593
C595

CR584

Q565

R576
R583
R588

VITS SWITCH CONTROL

C513
C580
C596
C598

CR585
CR588
CR651
CR662
CR664

Q658
Q730A
Q730B
Q560
Q570

R586
R587
R592
R594
R596

R597
R618
R662
R666
R668

R684
R710
R711
R713
R714
R876

PROGRAM VITS SWITCH

C748
C749
C779

Q640
Q680

R642
R654
R658
R659
R670

R674
R676
R677
R740
R746

R748
R770
R772
R773
R775

PREVIEW VITS SWITCH

C849
C879

Q840
Q885

R845
R847
R848
R849
R850

R854
R856
R870
R872
R874

R888
R940
R970
R971
R972
R975

U861

PROGRAM OUTPUT AMPLIFIER

C695
C696
C790
C844
C865

CR740
CR796

Q740
Q750
Q760
Q790
Q860
Q880

R692
R694
R698
R749
R750

R754
R756
R757
R759
R765

R766
R774
R785
R786
R790

R797
R840
R842
R843
R862

R863
R868
R883
R890
R893
R895

TP680

OFF BOARD COMPONENTS

J9001
J9003
J9005

POWER SUPPLY

C514
C610
C614
C692
C694
C998

PREVIEW OUTPUT AMPLIFIER

C898
C959
C968
C978
C989
C990

CR944
CR992

Q930
Q950
Q960
Q965
Q980
Q990

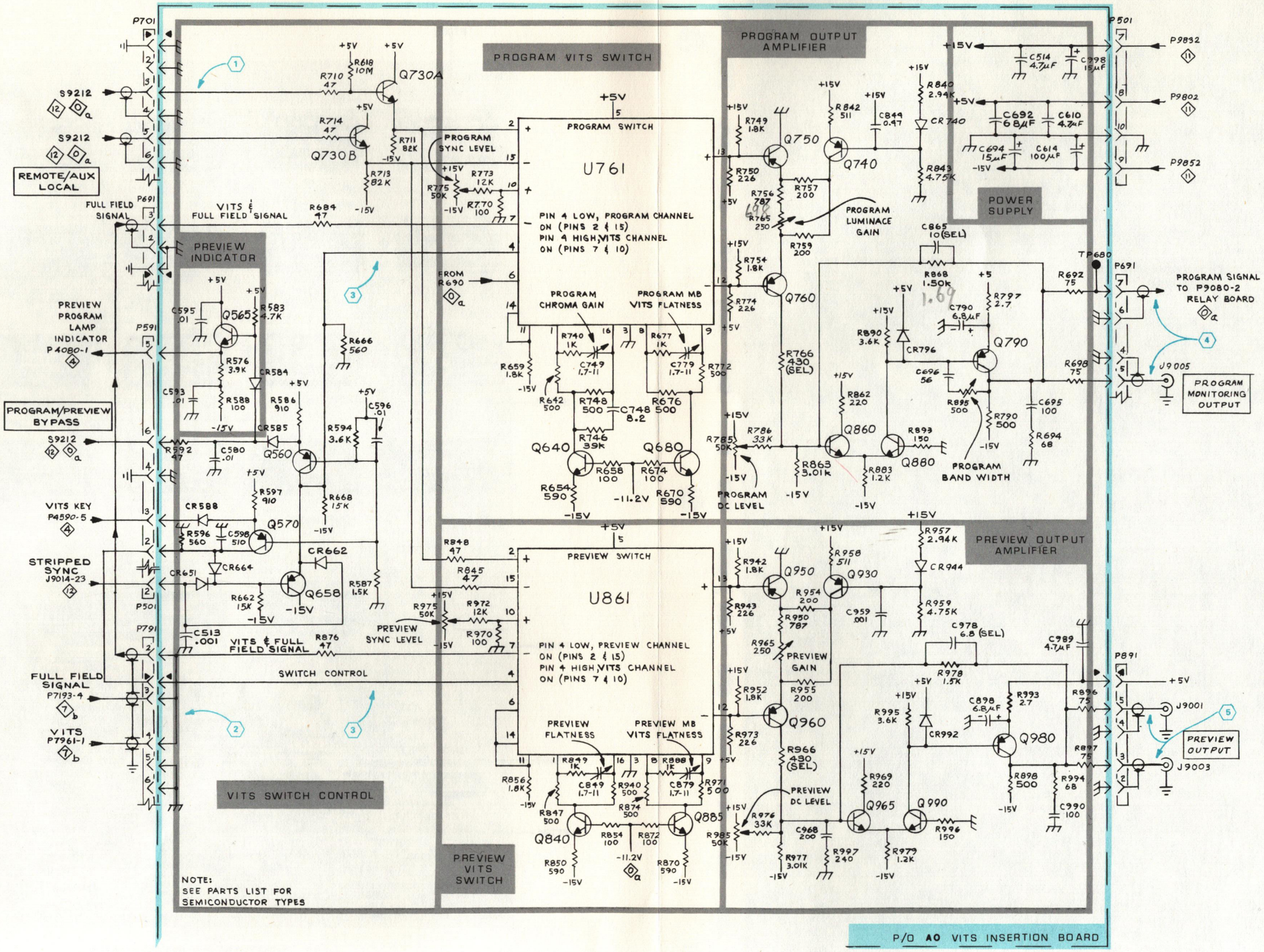
R896
R897
R942
R943
R950

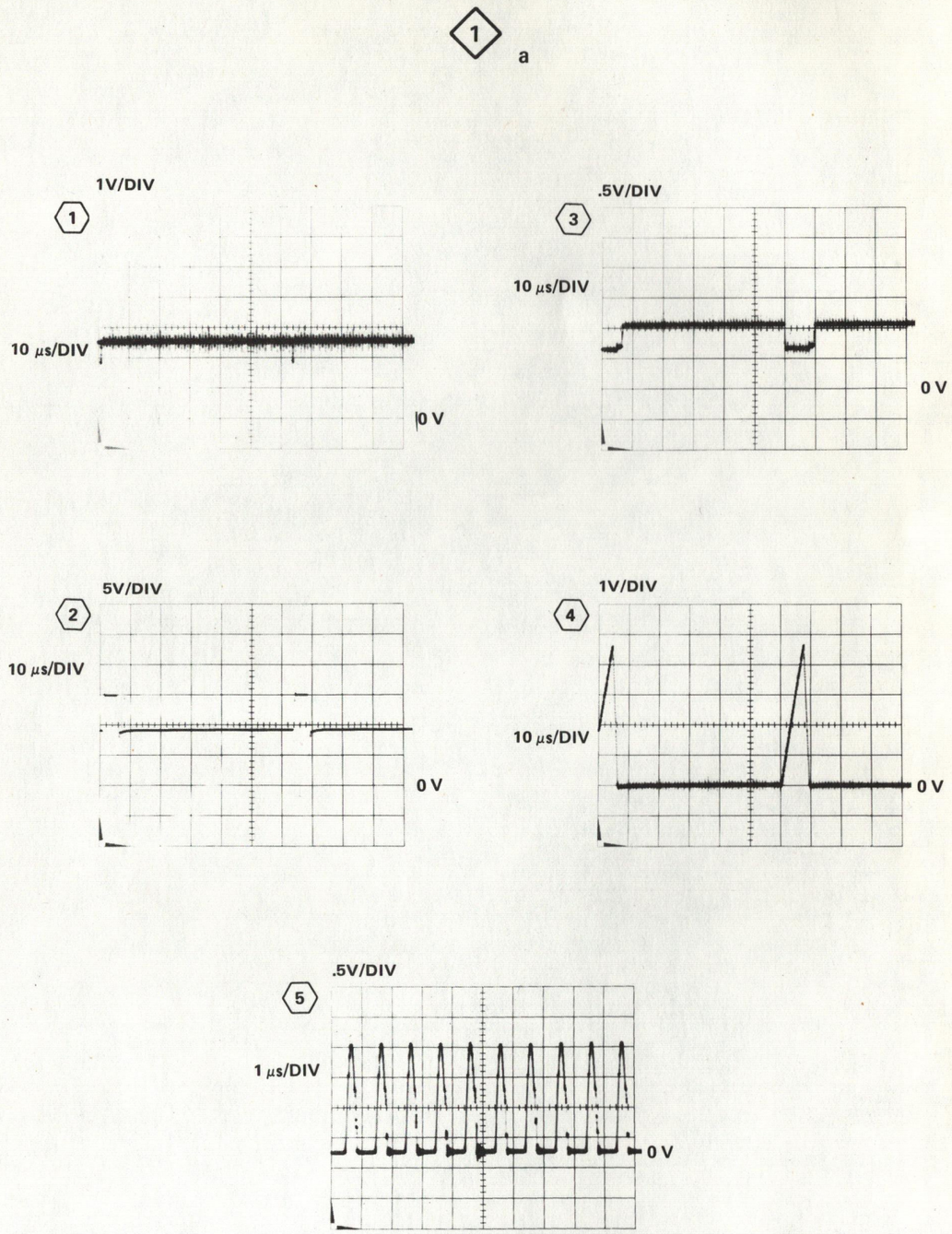
R952
R954
R955
R957
R958

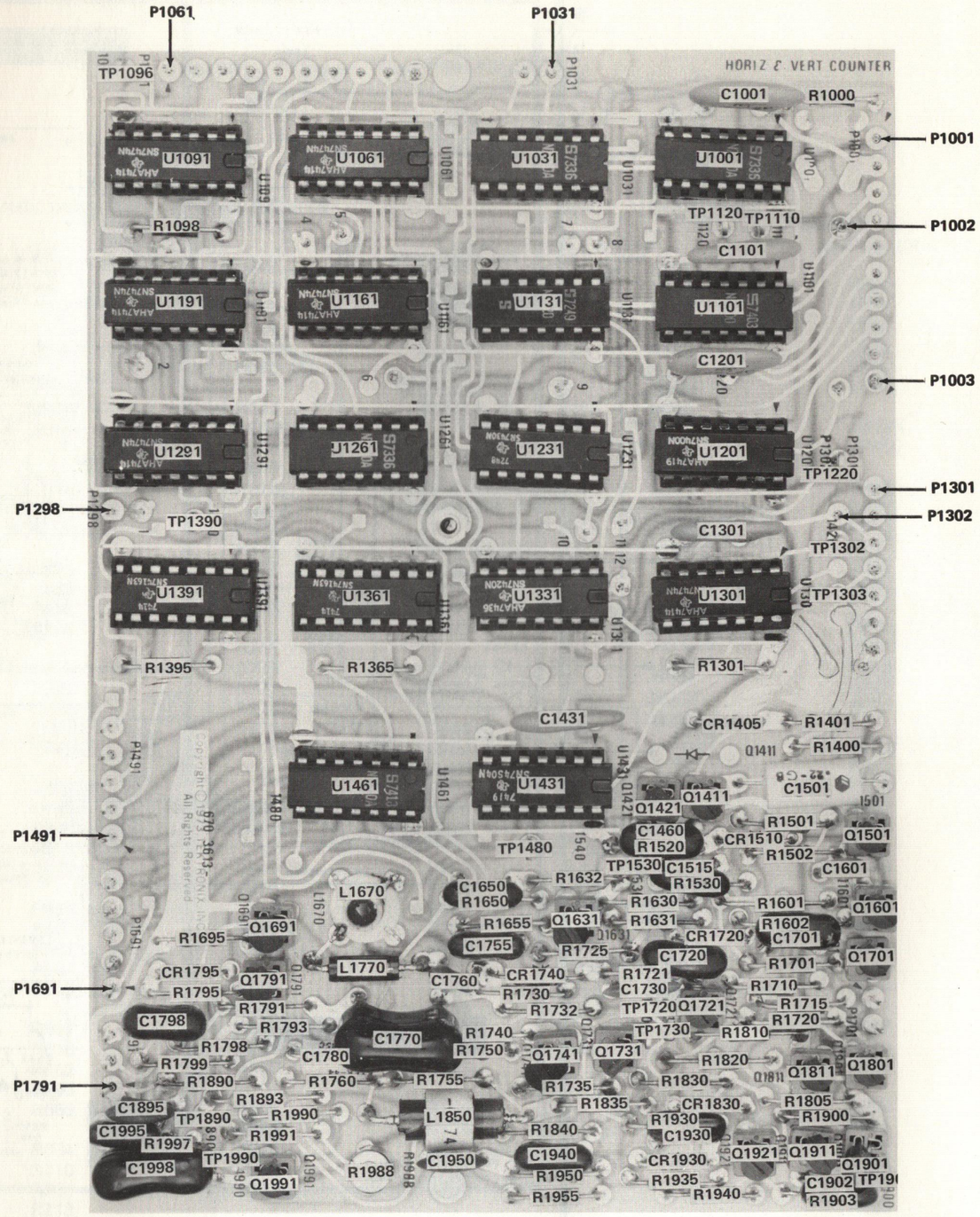
R959
R965
R966
R969
R973

R976
R977
R978
R979
R985

R993
R994
R995
R996
R997
R998


PROGRAM VITS SWITCH
PROGRAM OUTPUT AMPLIFIER
PREVIEW OUTPUT AMPLIFIER
POWER SUPPLY
PREVIEW VITS SWITCH
VITS SWITCH CONTROL
U761
PROGRAM SWITCH
PIN 4 LOW, PROGRAM CHANNEL ON (PINS 2 & 15)
PIN 4 HIGH, VITS CHANNEL ON (PINS 7 & 10)
U861
PREVIEW SWITCH
PIN 4 LOW, PREVIEW CHANNEL ON (PINS 2 & 15)
PIN 4 HIGH, VITS CHANNEL ON (PINS 7 & 10)
PROGRAM SYNC LEVEL
PREVIEW SYNC LEVEL
PROGRAM CHROMA GAIN
PROGRAM MB VITS FLATNESS
PREVIEW FLATNESS
PREVIEW MB VITS FLATNESS
PROGRAM LUMINACE GAIN
PREVIEW GAIN
PROGRAM DC LEVEL
PREVIEW DC LEVEL
PROGRAM BAND WIDTH
PROGRAM SIGNAL TO P9080-2 RELAY BOARD
PROGRAM MONITORING OUTPUT
PREVIEW OUTPUT
PREVIEW INDICATOR
PREVIEW PROGRAM LAMP INDICATOR P4080-1
PROGRAM/PREVIEW BYPASS
REMOTE/AUX LOCAL
VITS KEY P4590-5
STRIPPED SYNC J9014-23
FULL FIELD SIGNAL P7193-4
VITS P7961-1
VITS & FULL FIELD SIGNAL
SWITCH CONTROL
FROM R690
P701
P691
P591
P501
P791
P891
P9832
P9802
P9852
TP680
J9005
J9001
J9003
Q730A
Q730B
Q565
Q560
Q570
Q658
Q640
Q680
Q840
Q885
Q750
Q740
Q760
Q790
Q860
Q880
Q950
Q930
Q960
Q980
Q965
Q990
CR740
CR796
CR944
CR992
CR584
CR585
CR588
CR662
CR664
CR651
NOTE:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES
P/O A0 VITS INSERTION BOARD





A1 VERTICAL COUNTER BOARD

HORIZONTAL COUNTER

HORIZONTAL INTEGRATOR

C1902

Q1711
Q1811
Q1820
Q1901

R1715
R1720
R1805
R1810
R1820

R1900
R1903

TP1900

PHASE DETECTOR

C1720
C1730
C1755
C1930

CR1830
CR1930

L1850

Q1721
Q1921

R1721
R1725
R1755
R1830
R1835

R1930
R1935
R1940

TP1720
TP1730

POWER SUPPLY

C1001
C1101
C1201
C1301

OSC

C1431
C1760
C1770
C1798
C1995
C1998

CR1740

L1670
L1770

Q1691
Q1791

R1730
R1732
R1791
R1793
R1798

R1799
R1998

TP1480

DELAY

C1780
C1895
C1940
C1950

CR1795

Q1731
Q1741
Q1991

R1735
R1740
R1750
R1760
R1795

R1840
R1890
R1893
R1950
R1955

R1988
R1990
R1991

TP1890
TP1990

÷ 64 COUNTER

R1365
R1695

U1361
U1391
U1431B
U1431C
U1431E

FIELD RECOGNITION

TP1303

U1301B

VITS H BLANKING

R1301
R1365

U1301A
U1331B
U1461A

TP1302

OFF BOARD COMPONENTS

R9209

@

WAVEFORMS

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. H = HORIZ FREQUENCY.
3. UNUSED IC PINS ARE GROUNDED EXCEPT U1361
4. IC'S: PIN 7 IS GROUND, PIN 14 IS +5 VOLTS EXCEPT U1361 & U1391

P9832 P9852 P9802 P1301 P1001 P1298 P1491 P1691 P1791
P2000-9 2a P2000-4 2a P2000-5 2a P2000-6 2a P2000-7 2a P2000-8 2a P2400-2 2a
+15V -15V +5V
C1001 0.1 C1101 0.1 C1301 0.1 C1201 0.1 C1431 0.1
32H 16H 8H 4H 2H H
U1431C 74S04

POWER SUPPLY
÷64 COUNTER
VITS H BLANKING
FIELD RECOGNITION
DELAY
OSCILLATOR
AFC SAMPLER
HORIZONTAL INTEGRATOR

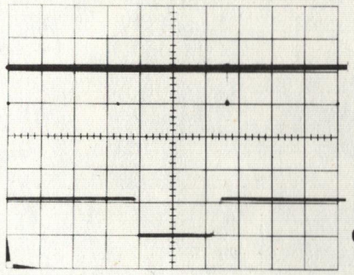
U1331B 7420
TO U1281B-11 1b
TP1302
R1301 1k
R1365 1k
U1461A 7410
VITS H BLANKING
U1301A 7474
P1301 P8600-2 8 P4290-2 4 P1302 P8100-3 8
U1431B 74S04
TO U1461B-3 1b
U1361 74163
U1391 74163 CARRY
R1395 1k
U1431E 74S04
R1695 180
U1461C 7410
U1301B 7474
TP1303
FROM U1161B-8 1b
FIELD 1&3 FIELD 2&4
P4500-3 4 P4500-2 4

Q1901 R1903 2.7k R1805 11k R1900 4.3k TP1900
TP1720 1 Q1721 R1721 120k CR1740 R1730 470k C1770 .01 R1791 10k
C1902 450 R1810 4.42k Q1911 C1730 .02 C1720 1000 C1755 180 C1760 0.1 R1732 1.5M R1793 33k
R1725 47k L1770 25µH -15V
C1798 1000 C1995 39 C1998 .01 R1798 820 R1799 22k R1998 24 Q1791 Q1691
TP1480 5
L1670 2.9-6.5 ≈1 MHz OSC
COMPOSITE SYNC P1701 FROM P5970-4 5a R1715 2.2k Q1801 Q1811 R1720 15k R1820 6.34k TO R1710 1b
R1830 4.7k CR1830 L1850 245µH R1755 6.2k R1835 1.2k C1930 33 CR1930 R1935 3.3k R1930 150k R1940 470 Q1921 TP1730 2
INSERT DELAY 12
R9209 10K P1791 C9209 .01 R1890 33k C1895 .01
R1955 47k C1940 330 R1740 1k Q1731 R1840 4.7k R1950 47k R1735 3.3k
R1988 10K SYNC DELAY R1991 100 C1950 .01
TP1990 R1760 4.7k C1780 1500 R1750 270 Q1741 4 Q1991 R1990 100
TP1890 3 R1893 17.4k R1795 390 CR1795

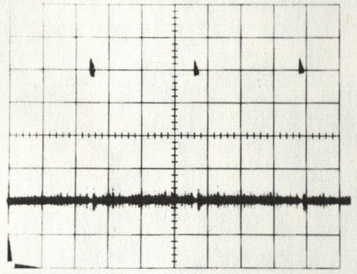
P/O A1 VERTICAL COUNTER BOARD

1 b

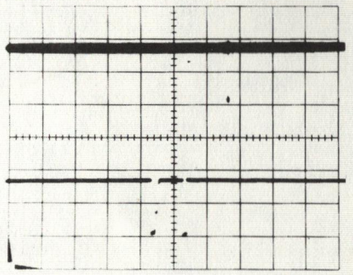
1 5V/DIV D.T.M. 6.60

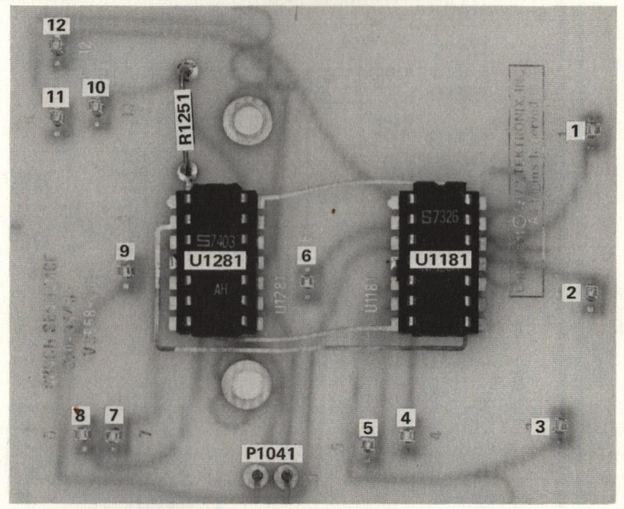


2 1V/DIV D.T.M. 6.60



3 2V/DIV D.T.M. 6.60





A15 BRUNCH SEQUENCE BOARD

VERTICAL COUNTER

◇1 b

BRUCH SEQUENCE BOARD

R1251

U1181
U1281A
U1281B

VERTICAL INTEGRATOR

C1460
C1501
C1601
C1701

CR1405
CR1720

Q1411
Q1501
Q1601
Q1701

R1400
R1401
R1501
R1502
R1602

R1610
R1701
R1710

÷ 525 COUNTER

C1515
C1650

CR1510

Q1421
Q1631

R1098
R1520
R1530
R1630
R1631

R1632
R1650
R1655

TP1350

U1061A
U1061B
U1091A
U1091B
U1161A

U1161B
U1191A
U1191B
U1291A
U1291B

CLOCK

TP1096

U1461B

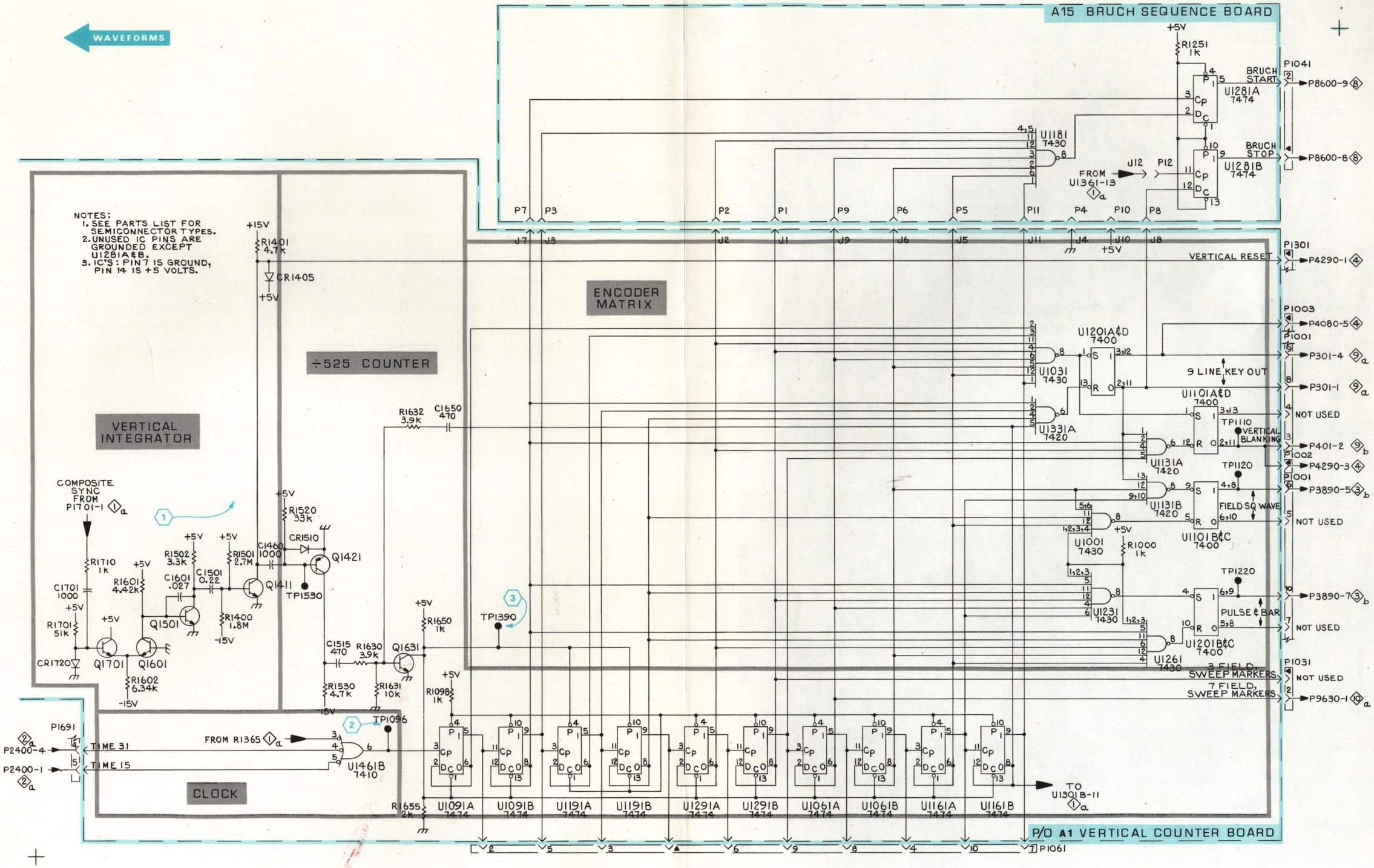
MATRIX

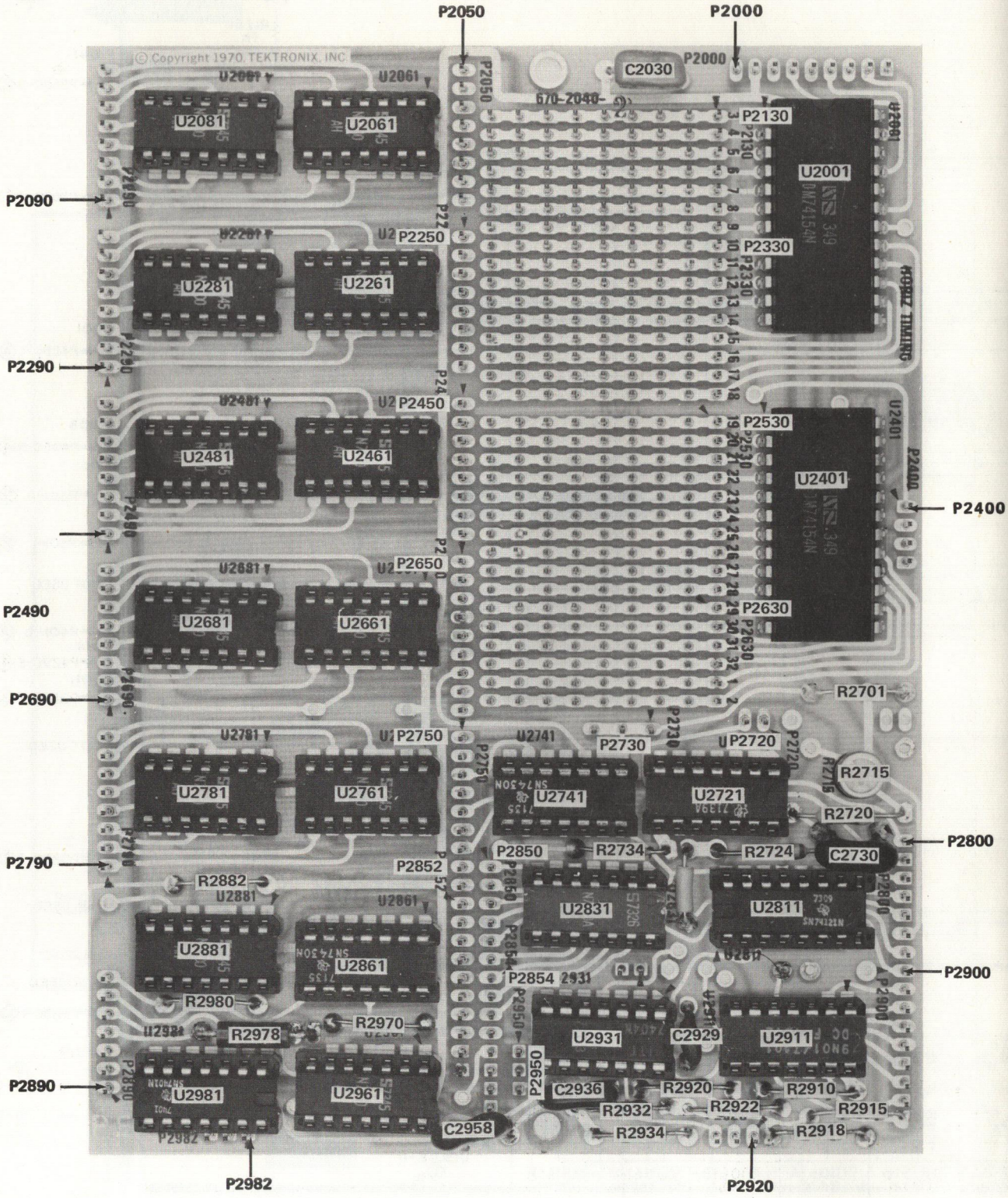
R1000

TP1110
TP1120
TP1220
TP1390

U1001
U1031
U1101A & D
U1101 B & C
U1131A

U1131B
U1201A & D
U1201B & C
U1231
U1261
U1331A


A15 BRUCH SEQUENCE BOARD
NOTES:
1. SEE PARTS LIST FOR SEMICONNECTOR TYPES.
2. UNUSED IC PINS ARE GROUNDED EXCEPT U1281A&B.
3. IC'S: PIN 7 IS GROUND, PIN 14 IS +5 VOLTS.
ENCODER MATRIX
÷525 COUNTER
VERTICAL INTEGRATOR
CLOCK
COMPOSITE SYNC FROM P1701-1
FROM R1365
TIME 31
TIME 15
P2400-4
P2400-1
P1691
R1401 4.7K
CR1405
R1710 1K
C1701 1000
R1701 51K
R1601 4.42K
R1502 3.3K
C1601 .027
C1501 0.22
R1501 2.7M
R1400 1.8M
C1460 1000
CR1510
R1520 33K
Q1421
Q1411
TP1530
Q1501
Q1701
Q1601
CR1720
R1602 6.34K
R1632 3.9K
C1650 470
C1515 470
R1630 3.9K
Q1631
R1530 4.7K
R1631 10K
R1650 1K
TP1390
TP1096
R1098 1K
R1655 2K
U1461B 7410
U1091A 7474
U1091B 7474
U1191A 7474
U1191B 7474
U1291A 7474
U1291B 7474
U1061A 7474
U1061B 7474
U1161A 7474
U1161B 7474
TO U1301B-11
P/O A1 VERTICAL COUNTER BOARD
P1061
R1251 1K
U1281A 7474
U1281B 7474
U1181 7430
FROM U1361-13
BRUCH START
BRUCH STOP
P1041
P8600-9
P8600-8
P7 P3 P2 P1 P9 P6 P5 P11 P4 P10 P8
J7 J3 J2 J1 J9 J6 J5 J11 J4 J10 J8
VERTICAL RESET
P1301
P4290-1
P1003
P4080-5
P1001
P301-4
9 LINE KEY OUT
P301-1
U1201A&D 7400
U1031 7430
U1101A&D 7400
U1331A 7420
TP1110
VERTICAL BLANKING
P401-2
P1002
P4290-3
U1131A 7420
TP1120
P3890-5
U1131B 7420
FIELD SQ WAVE
NOT USED
U1101B&C 7400
U1001 7430
R1000 1K
TP1220
P3890-7
PULSE & BAR
NOT USED
U1231 7430
U1201B&C 7400
U1261 7430
3 FIELD SWEEP MARKERS
7 FIELD SWEEP MARKERS
P1031
NOT USED
P9630-1



A2 HORIZONTAL TIMING BOARD

HORIZONTAL TIMING

INSTANT DECODER

C2030

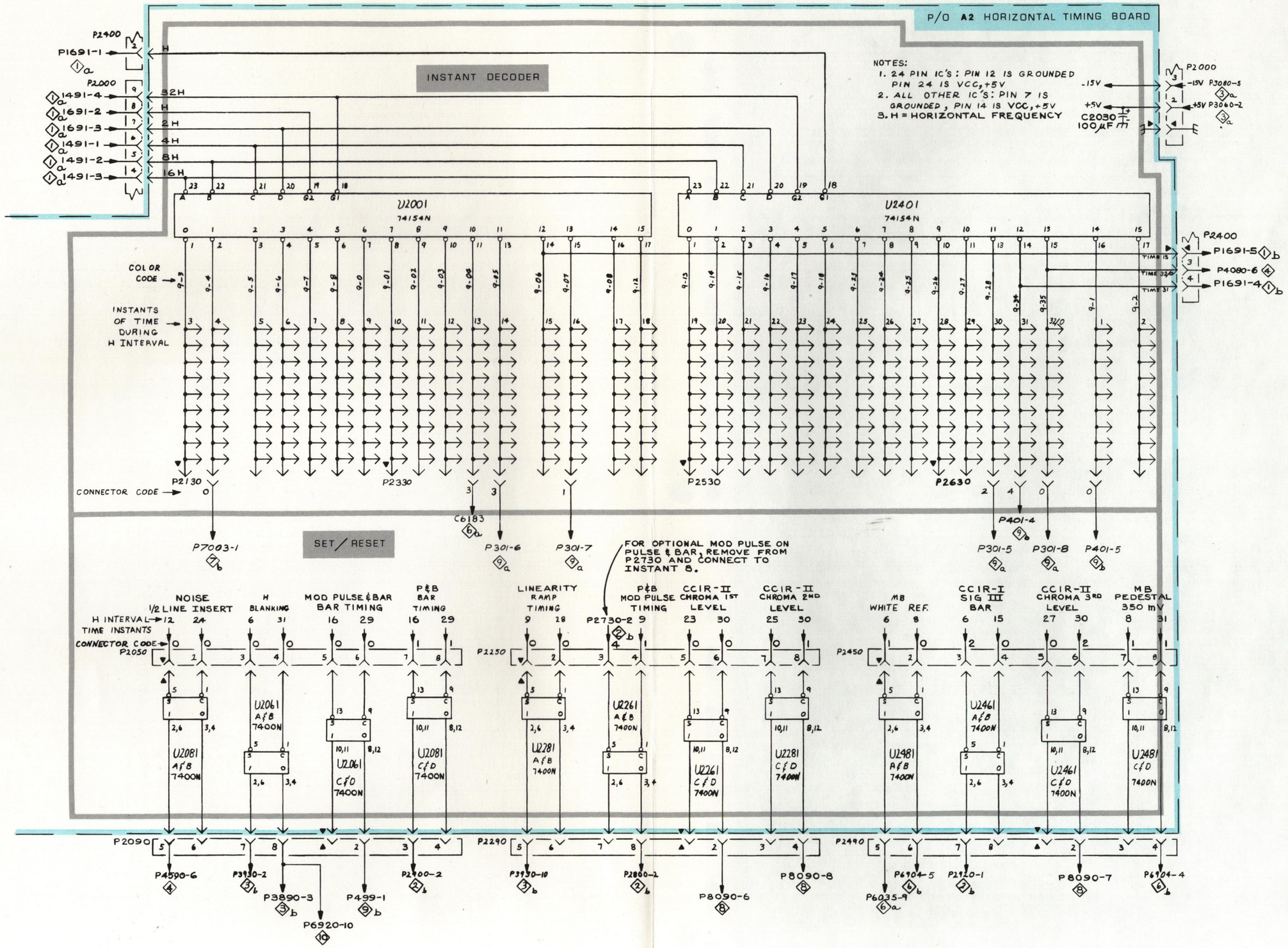
U2001
U2401

SET/RESET

U2061A & B
U2061C & D
U2081A & B
U2081C & C
U2261A & B

U2261 C & D
U2281A & B
U2281C & D
U2461A & B
U2461C & D

U2481A & B
U2481C & D


P/O A2 HORIZONTAL TIMING BOARD
INSTANT DECODER
NOTES:
1. 24 PIN IC'S: PIN 12 IS GROUNDED PIN 24 IS VCC, +5V
2. ALL OTHER IC'S: PIN 7 IS GROUNDED, PIN 14 IS VCC, +5V
3. H = HORIZONTAL FREQUENCY
P2400
P1691-1
P2000
P1491-4
P1691-2
P1691-3
P1491-1
P1491-2
P1491-3
H
32H
16H
8H
4H
2H
U2001
74154N
U2401
74154N
-15V
+5V
C2030
100µF
P3080-5
P3060-2
P2000
P2400
P1691-5
P4080-6
P1691-4
TIME 15
TIME 32/0
TIME 31
COLOR CODE
INSTANTS OF TIME DURING H INTERVAL
CONNECTOR CODE
P2130
P2330
P2530
P2630
C6183
P401-4
P7003-1
SET / RESET
P301-6
P301-7
P301-5
P301-8
P401-5
FOR OPTIONAL MOD PULSE ON PULSE & BAR, REMOVE FROM P2730 AND CONNECT TO INSTANT 8.
NOISE 1/2 LINE INSERT
H BLANKING
MOD PULSE & BAR BAR TIMING
P&B BAR TIMING
LINEARITY RAMP TIMING
P&B MOD PULSE TIMING
CCIR-II CHROMA 1ST LEVEL
CCIR-II CHROMA 2ND LEVEL
MB WHITE REF.
CCIR-I SIG III BAR
CCIR-II CHROMA 3RD LEVEL
MB PEDESTAL 350 mV
H INTERVAL TIME INSTANTS
CONNECTOR CODE
P2050
P2250
P2730-2
P2450
U2061 A&B 7400N
U2081 A&B 7400N
U2081 C&D 7400N
U2061 C&D 7400N
U2281 A&B 7400N
U2261 A&B 7400N
U2261 C&D 7400N
U2281 C&D 7400N
U2481 A&B 7400N
U2461 A&B 7400N
U2461 C&D 7400N
U2481 C&D 7400N
P2090
P2290
P2490
P4590-6
P3930-2
P3890-3
P6920-10
P499-1
P2900-2
P3930-10
P2800-2
P8090-6
P8090-8
P6035-9
P6704-5
P2920-1
P8090-7
P6704-4

HORIZONTAL TIMING

LINEARITY STAIRCASE LOGIC

U2831
U2961C

MULTIBURST WIDTH

C2730

R2710
R2715
R2720
R2724

U2741
U2811A
U2831C

½ INSTANT DELAY

C2936
C2958

R2920
R2932
R2934

U2931E
U2961D

MOD PULSE TIMING

R2910
R2918

U2911B
U2911D
U2931B

BAR TIMING

R2915

U2911A
U2911C

PULSE TIMING

C2929

R2734

U2721
U2931D
U2931F

CCIR-1 & SIG III

R2970

U2861

MODULATION LOGIC

R2882
R2978
R2980

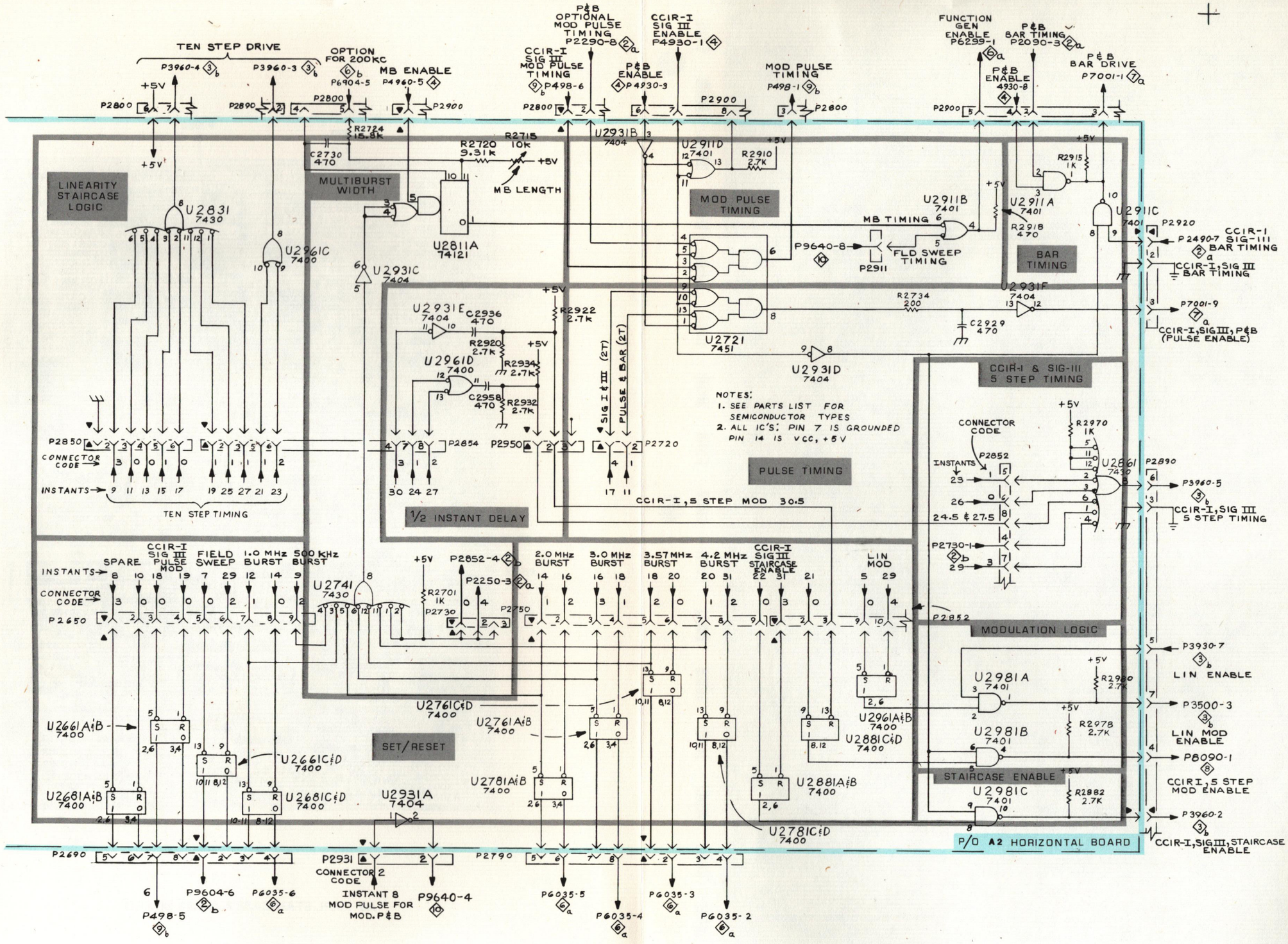
U2981A
U2981B
U2981C

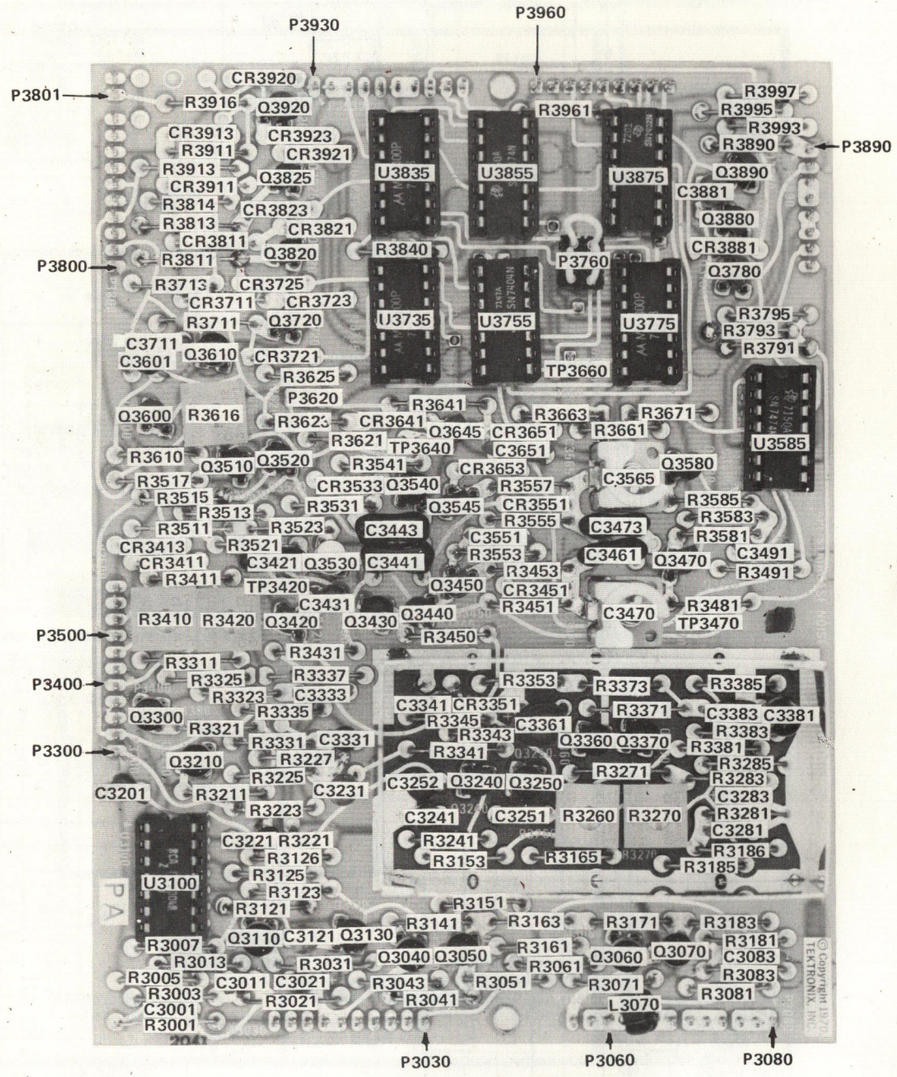
SET/RESET

U2661A & B
U2661C & D
U2681C & D
U2681A & B
U2961A

U2761A & B
U2761C & D
U1781A & B
U1781C & D

U2881A & B
U2881C & D
U2961A & B


TEN STEP DRIVE
P3960-4
P3960-3
OPTION FOR 200KC
P6904-5
MB ENABLE
P4960-5
P&B OPTIONAL MOD PULSE TIMING
P2290-8
CCIR-I SIG III MOD PULSE TIMING
P498-6
P&B ENABLE
P4930-3
CCIR-I SIG III ENABLE
P4930-1
MOD PULSE TIMING
P498-1
FUNCTION GEN ENABLE
P6299-1
P&B BAR TIMING
P2090-3
P&B ENABLE
4930-8
P&B BAR DRIVE
P7001-1
P2800
P2890
P2900
+5V
R2724 15.8K
C2730 470
R2720 9.31K
R2715 10K
MB LENGTH
LINEARITY STAIRCASE LOGIC
MULTIBURST WIDTH
MOD PULSE TIMING
BAR TIMING
U2831 7430
U2961C 7400
U2931C 7404
U2811A 74121
U2931B 7404
U2911D 7401
R2910 2.7K
U2911B 7401
MB TIMING
P9640-8
P2911
FLD SWEEP TIMING
U2911A 7401
R2915 1K
R2918 470
U2911C 7401
P2920
CCIR-1 SIG-III BAR TIMING
CCIR-I,SIG III BAR TIMING
P7001-9
CCIR-I,SIGIII,P&B (PULSE ENABLE)
U2931E 7404
C2936 470
R2922 2.7K
R2920 2.7K
U2961D 7400
R2934 2.7K
C2958 470
R2932 2.7K
U2721 7451
U2931F 7404
R2734 200
C2929 470
U2931D 7404
SIG I & III (2T)
PULSE & BAR (2T)
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. ALL IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V
CCIR-I & SIG-III 5 STEP TIMING
PULSE TIMING
P2850
CONNECTOR CODE
INSTANTS
9 11 13 15 17 19 25 27 21 23
TEN STEP TIMING
P2854
P2950
P2720
30 24 27
17 11
½ INSTANT DELAY
CCIR-I,5 STEP MOD 30.5
CONNECTOR CODE
P2852
INSTANTS
23
26
24.5 & 27.5
P2730-1
29
R2970 1K
U2861 7430
P2890
P3960-5
CCIR-I,SIG III 5 STEP TIMING
SPARE
CCIR-I SIG III PULSE MOD
FIELD SWEEP
1.0 MHz BURST
500 KHz BURST
2.0 MHz BURST
3.0 MHz BURST
3.57 MHz BURST
4.2 MHz BURST
CCIR-I SIG III STAIRCASE ENABLE
LIN MOD
INSTANTS
8 10 18 19 7 29 12 14 9 14 16 16 18 18 20 20 31 22 31 21 5 29
CONNECTOR CODE
P2650
U2741 7430
R2701 1K
P2730
P2852-4
P2250-3
P2750
MODULATION LOGIC
P3930-7
LIN ENABLE
U2981A 7401
R2980 2.7K
P3500-3
LIN MOD ENABLE
U2981B 7401
R2978 2.7K
P8090-1
CCIRI,5 STEP MOD ENABLE
STAIRCASE ENABLE
U2981C 7401
R2882 2.7K
P3960-2
CCIR-I,SIGIII,STAIRCASE ENABLE
U2661A&B 7400
U2661C&D 7400
U2681A&B 7400
U2681C&D 7400
U2931A 7404
U2761C&D 7400
U2761A&B 7400
U2781A&B 7400
U2781C&D 7400
U2881A&B 7400
U2881C&D 7400
SET/RESET
P2690
P2931
CONNECTOR 2 CODE
INSTANT 8 MOD PULSE FOR MOD. P&B
P2790
P9604-6
P6035-6
P9640-4
P6035-5
P6035-4
P6035-3
P6035-2
P498-5
P/O A2 HORIZONTAL BOARD



A3 APL STAIRCASE & NOISE BOARD

@

NOISE GENERATOR

3 a

NOISE PREAMP

C3241
C3292
C3251
C3281
C3283

C3341
C3361

CR3351

L3070

Q3240
Q3250
Q3360

R3153
R3165
R3185
R3186
R3241

R3260
R3270
R3271
R3281
R3283

R3341
R3343
R3345
R3353
R3381

NOISE GENERATOR

C3381
C3383

Q3370

R3285
R3371
R3373
R3383
R3385

OFF BOARD COMPONENTS

J9240

R9231
R9232
R9233
R9234
R9235

R9236
R9237
R9238
R9239

NOISE AMPLIFIER

C3001
C3011
C3021
C3083
C3201

C3221
C3231
C3331
C3333

Q3040
Q3050
Q3060
Q3070
Q3110

Q3130
Q3210
Q3300

R3001
R3003
R3005
R3007
R3013

R3021
R3031
R3041
R3043
R3051

R3061
R3071
R3081
R3083
R3121

R3123
R3125
R3126
R3141
R3151

R3161
R3163
R3171
R3181
R3183

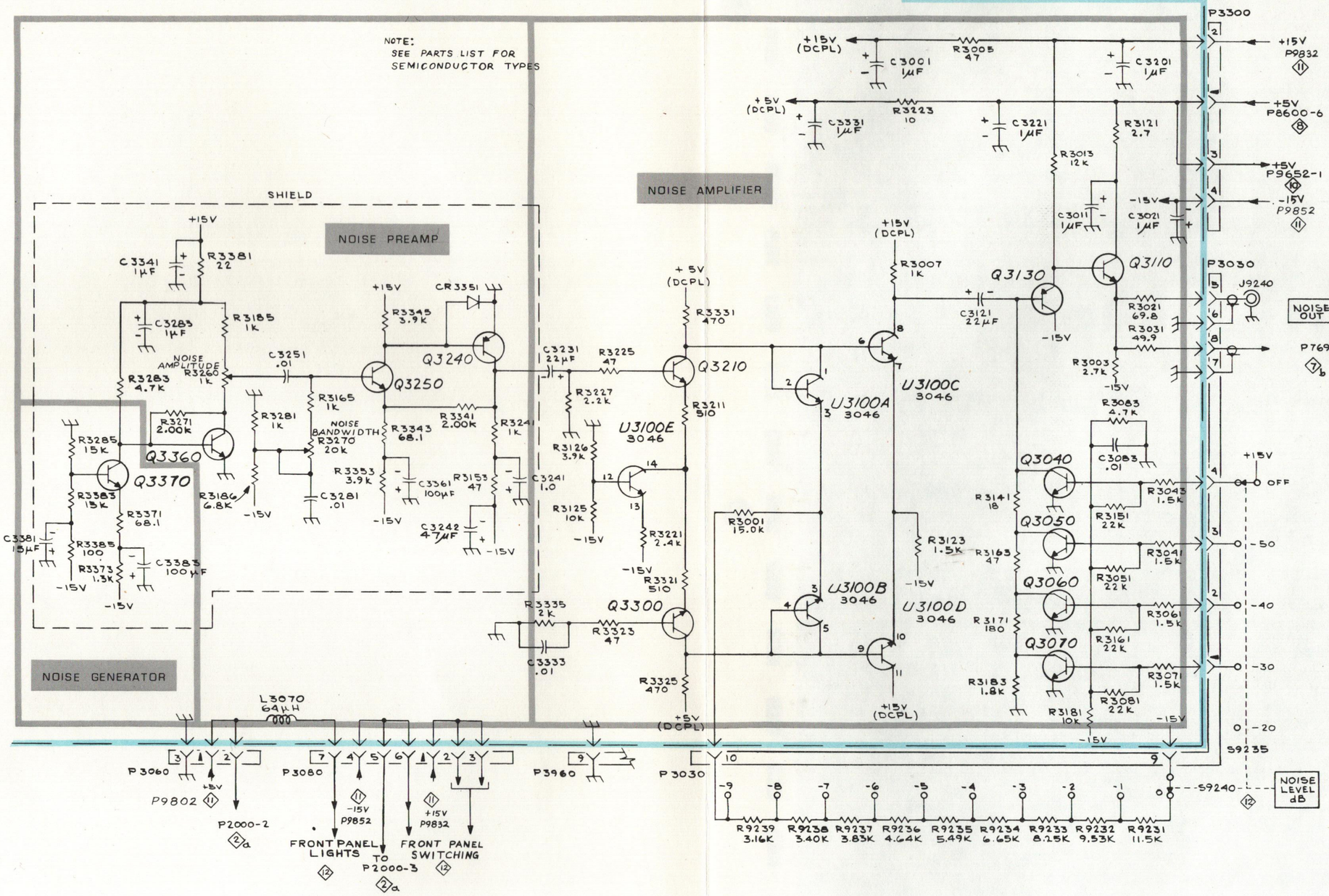
R3211
R3221
R3223
R3225
R3227

R3321
R3323
R3325
R3327

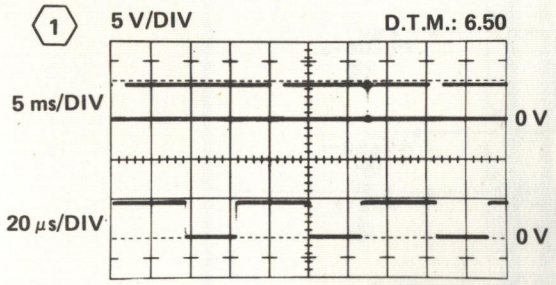
R3321
R3323
R3325
R3331
R3335

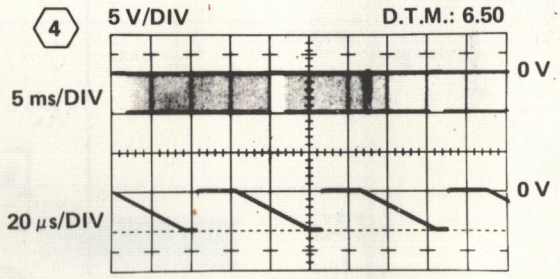
U3100A
U3100B
U3100C
U3100D
U3100E

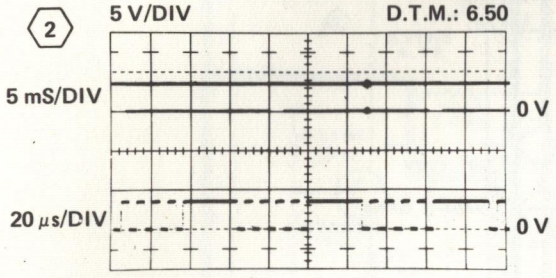
P/O A3 APL STAIRCASE & NOISE BOARD

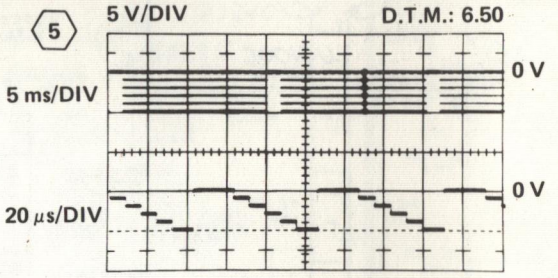


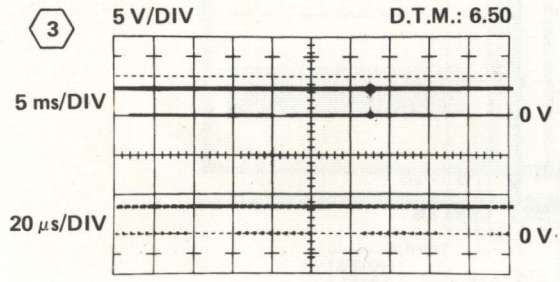
3 b

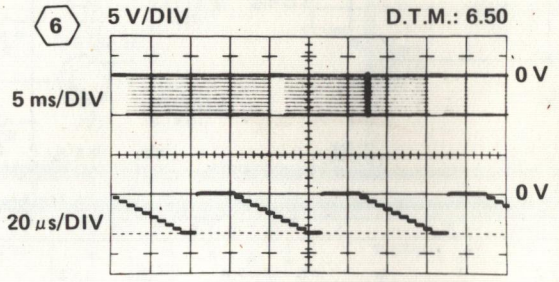












Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page except: All Waveforms, FULL FIELD SIG Mode switch set to LINEARITY; Waveform 1 & 4, LINEARITY Mode switch set to RAMP; and Waveform 2 & 5, LINEARITY MODE switch set to 5 STEP.

STAIRCASE & APL

◇3 b

APL

CR3711
CR3721
CR3723
CR3725
CR3811

CR3821
CR3823
CR3911
CR3913
CR3920

CR3921
CR3923

Q3720
Q3820
Q3825
Q3920

R3711
R3811
R3813
R3814
R3890

R3911
R3913
R3916

U3835C
U3735D

LINEARITY MODULATION AMPLITUDE

CR3411
CR3413

Q3420

R3311
R3337
R3410
R3411
R3420

BOUNCE GENERATOR

C3881

CR3881

Q3780
Q3880
Q3890

R3791
R3793
R3795
R3840
R3961

U3735C
U3835B
U3835D
U3855B

CONTROL LOGIC

R3761
R3993
R3995
R3997

U3735A
U3735B
U3755A
U3755B
U3755C

U3755D
U3755E
U3775A
U3775B
U3775C

U3775D
U3835A
U3855A
U3875B
U3875C
U3875D

PULSE & BAR

R3491

U3585B

FIELD SQUARE WAVE

U3585A

OFF BOARD COMPONENTS

R9280

INTEGRATOR

C3421
C3431
C3441
C3443

CR3531
CR3533

Q3430
Q3440
Q3510
Q3520
Q3530

Q3540
Q3600

R3431
R3450
R3600

R3431
R3450
R3511
R3513
R3515

R3517
R3521
R3523
R3531
R3541
R3610

10 STEP, 5 STEP RAMP DRIVE

C3461
C3470
C3473
C3491
C3551

C3565
C3601
C3651

CR3451
CR3551
CR3641
CR3653
CR3651

Q3450
Q3470
Q3545
Q3580
Q3645

R3451
R3452
R3481
R3553
R3555

R3557
R3581
R3583
R3585
R3616

R3621
R3623
R3641
R3661
R3663

TP3640
TP3660

0.6 V SUPPLY

Q3610

R3713

TP3420

WAVEFORMS

R9280 500k BOUNCE RATE

P3890

+5V

H BLANKING

FLAT FIELD ENABLE

GND. FOR WHITE

GND FOR BLACK -15V

GND FOR VAR APL

APL

BOUNCE GENERATOR

R3890 51K

R3791 3.3 M

C3881 6.8μF 15V

R3793 3.3M

R3795 7.5K

CR3881

U3835B 7400

U3855B 7474

R3961 4.7K

R3840 4.7K

R3825 1K

U3835C 7400

U3735D 7400N

CR3923

CR3913

Q3920

CR3920

R3911 1K

R3916 1K

+0.6V

R3913 5.23k

-15V

CR3921

U3835D 7400

Q3825

CR3823

CR3911

U3735C 7400

Q3820

CR3725

CR3821

CR3811

Q3720

CR3721

CR3723

CR3711

R3814 10

R3813 30.9K

R3811 5.11K

R3711 5.23K

LINEARITY MODULATION AMPLITUDE

LIN MOD ENABLE ②b P2890-7

100mV 140mV MOD ⑧ P8090-3

140mV MOD AMPLITUDE

100mV MOD AMPLITUDE

P3500

CR3913

CR3911

R3411 100

Q3420

R3337 78.7k

R3420 20K

R3311 56.2k

R3410 20K

P3400

S9255 100mV ⑫

S9255 SUB-CARRIER ⑫

S9255 140mV ⑫

P3800

P7101-5 ⑦a

R9290 0-15% ⑫ BLACK

S9250 MULTI AMP ⑫

R9285 85-100% ⑫ WHITE

S9290 % PEAK WHITE ⑫

P4930-7 ④

P3890

HIGH FOR PULSE & BAR

P3930

P4590-4 ④

P2090-7 ②a

P4980-8 ⑨b

S9285 WHITE ⑫

P3960

S9285 BLACK ⑫

S9275 FLAT FIELD

P3890

P1001-10 ①b

P2090-8 ②a

P8090-9 ⑧

P1001-6 ①b

PULSE & BAR

H BLANKING

FIELD SQ WAVE (50%)

PULSE & BAR

R3491 4.7K

U3585B 7474

U3585A 7474

FIELD SQUARE WAVE

P3960

P2890-1 ②b

CCIR-1, SIG-III STAIRCASE ENABLE

CONTROL LOGIC

U3735A 7400

U3735B 7400

R3513 5.1K

S9253 10 STEP ⑫

S9253 5 STEP ⑫

S9253 RAMP ⑫

P2800-7 ②b

P2890-2 ②b

P2890-6 ②b

P4960-2 ④

P2890-5 ②b

P2290-3 ⑧a

P3930

R3995 4.7k GND FOR 10 STEPS

R3993 4.7k GND FOR 5 STEPS

R3997 4.7k GND. FOR RAMP

U3875C 7402

10 STEP TIMING

U3875B 7402

U3875A 7402

U3855A 7474

U3755B 7404

U3755E 7404

U3875D 7402

CCIR-1, SIG-III STEP TIMING

LIN. ENABLE

RAMP TIMING

U3755C 7404

U3775C 7400

U3775D 7400

U3775B 7400

U3775A 7400

R3671 2.7K

R3581 15K

U3755A 7404

U3835A 7400

U3755D 7404

R3663 2.7K

CR3651

R3616 20K

R3621 36.5K

R3614 4.32K

TP3660

TP3640

Q3520 10 STEP AMPL.

Q3470

TP3470

C3470 2.4-24.5

Q3600

Q3510

Q3540

R3531 56K

CR3533

CR3531

R3517 3.9K

R3610 47

R3541 6.8K

R3515 5.6K

+15V

+5V

-15V

10 STEP 5 STEP RAMP DRIVE

R3491 2.7K

R3511 100K

C3491 0.1

Q3580 5 STEP AMPL.

C3565 2.4-24.5

CR3551

C3473 170

R3583 15K

R3585 1K

R3555 43K

R3557 330

Q3545

R3453 330

Q3450

CR3451

C3461 70

INTEGRATOR

C3443 790

C3441 790

R3431 7.5K

Q3430

Q3440

Q3530

R3450 7.5K

R3521 15K

C3421 10

C3431 1μF 50V

R3523 10

R3511 4.74K

TP3420

P3800

P7101-7 ⑦a

0.6V SUPPLY

R3713 1K

+0.6V

Q3610

C3601 1μF

R3623 10 (SEL)

Q3645

CR3641

CR3653

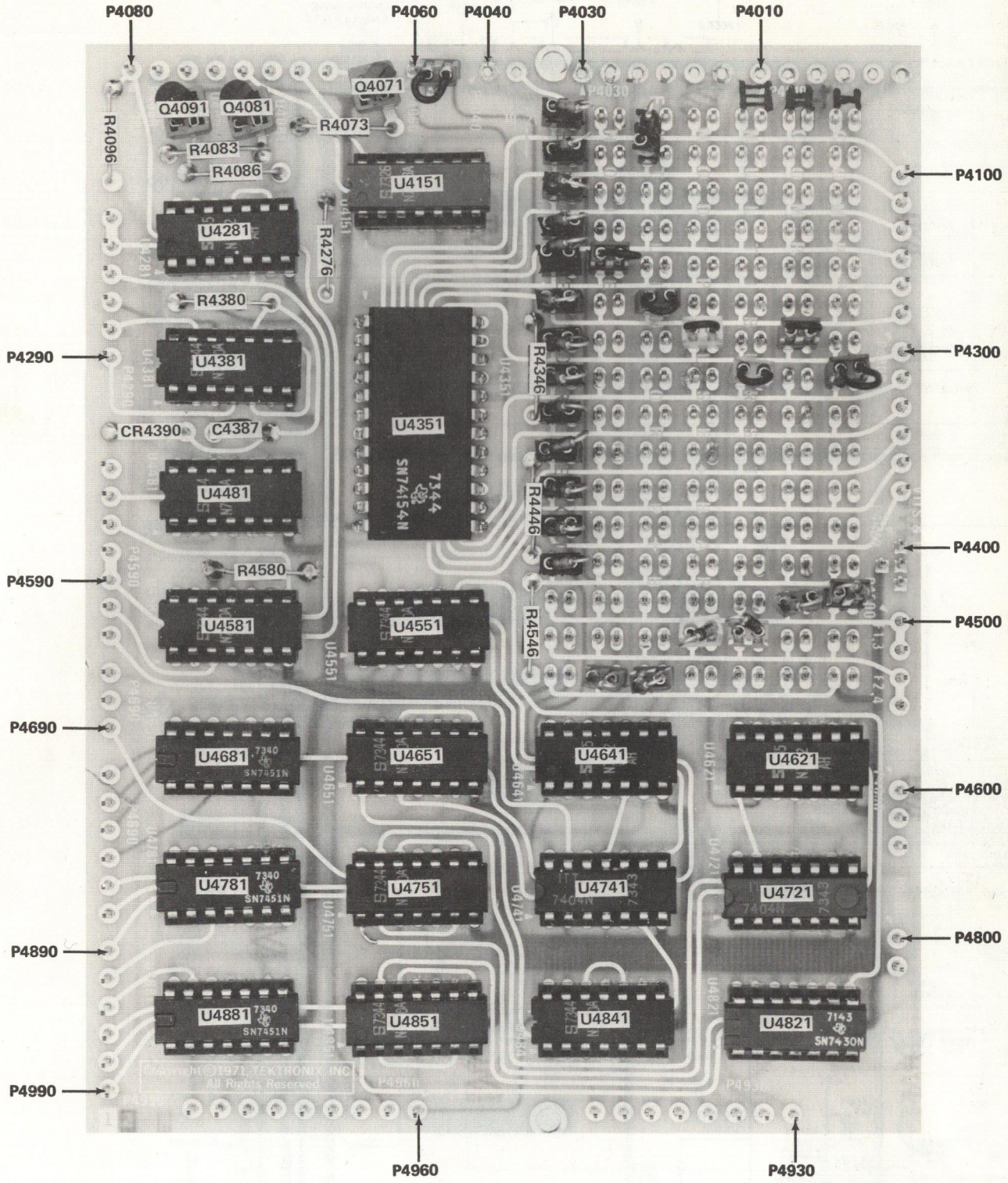
C3651 .02

C3551 .02

R3553 10k

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. ALL IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V

P/O **A3** APL STAIRCASE & NOISE BOARD



A4 VITS & FULL FIELD BOARD

VITS & FULL FIELD LOGIC

4

FULL FIELD LOGIC

U4551B
U4651B
U4651C
U4681
U4721A

U4741F
U4751B
U4751C
U4781
U4841B

U4851B
U4851C
U4881

VITS OR FULL FIELD

U4551A
U4641B
U4651A
U4651D
U4741B

U4741E
U4751A
U4751D
U4841A
U4851A
U4851D

LOGIC CONTROL

U4581A
U4581B
U4741A
U4841C
U4841D

AUX

C4387

CR4390

U4381A
U4381D

LINE COUNTER

U4151
U4351

VITS NONSYNCHRONOUS INHIBIT

R4276
R4380
R4546

U4381B&C

NOISE LOCK

R4580

U4281B
U4481A
U4481B
U4481C
U4481D
U4581D

INDICATOR LOGIC

Q4071
Q4081
Q4091

R4073
R4083
R4086

U4281C
U4281D

VITS KEY

R4096
R4346
R4446

U4551C
U4551D
U4581C
U4741D
U4821

VITS LINE & FIELD MATRIX

U4621A
U4621B
U4621C
U4621D
U4641A

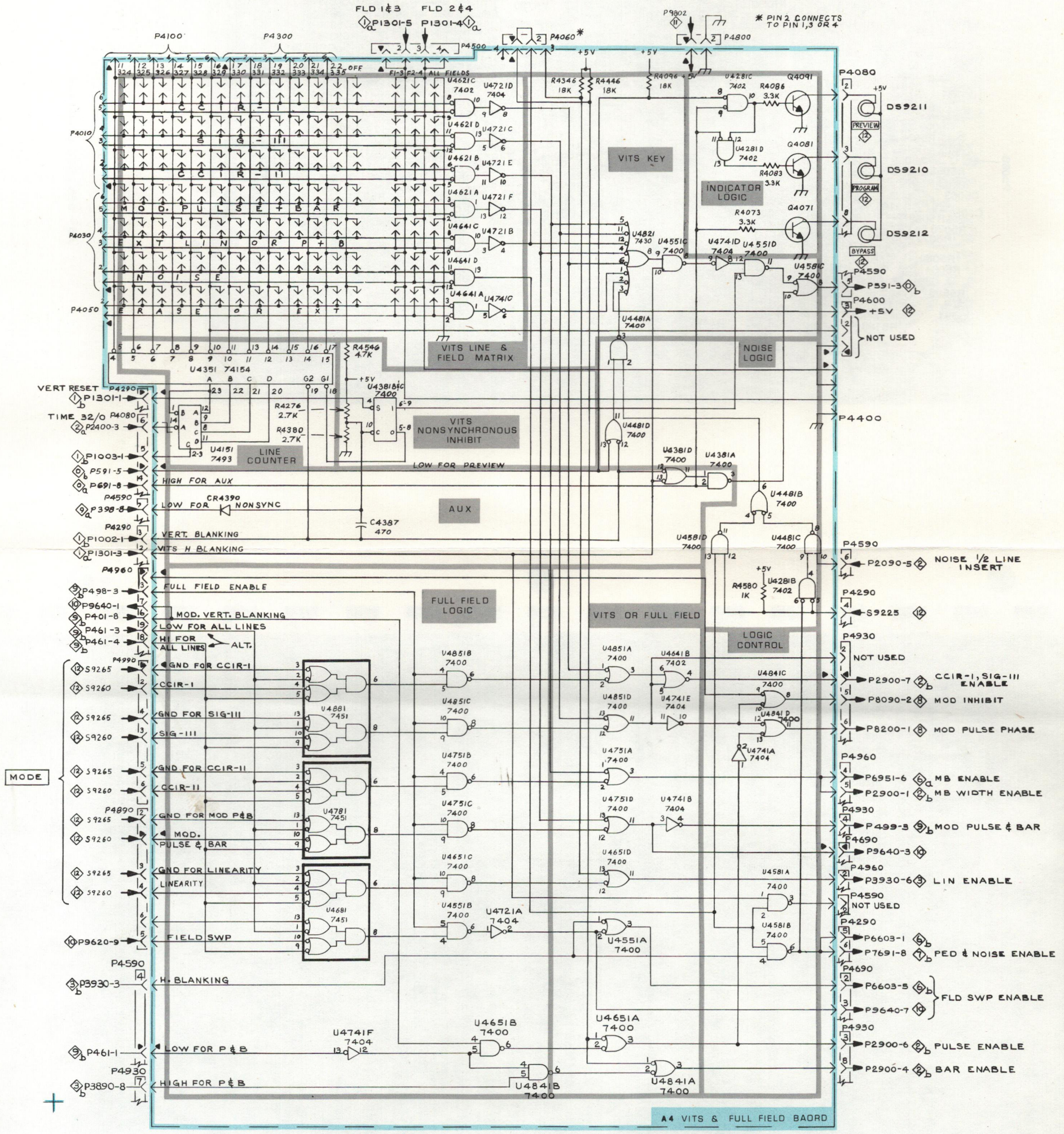
U4641C
U4641D
U4721B
U4721C
U4721D

U4721E
U4721F
U4741C

OFF BOARD COMPONENTS

DS9210
DS9211
DS9212

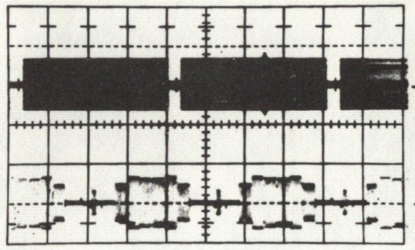
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPE
2. U4151: PIN 10 IS GROUNDED PIN 5 IS VCC, +5V
3. U4351: PIN 12 IS GROUNDED PIN 24 IS VCC, +5V
4. ALL OTHER IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V



VITS & FULL FIELD LOGIC 4 12-74

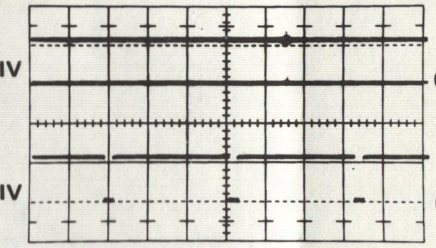
5 a

1 — 100 mV/DIV — D.T.M.: 6.50

5 ms/DIV


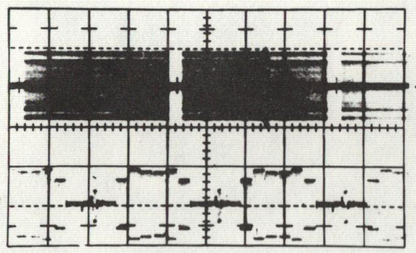
20 µs/DIV

5 — 5 V/DIV — D.T.M.: 6.50

5 ms/DIV


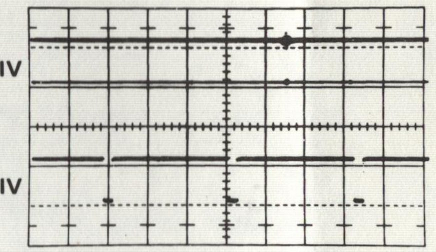
20 µs/DIV

2 — 200 mV/DIV — D.T.M.: 6.50

5 ms/DIV


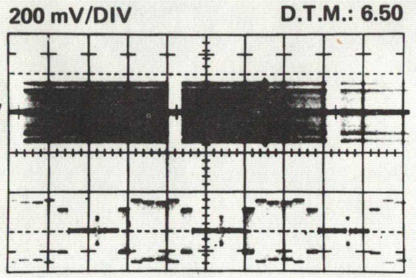
20 µs/DIV

6 — 5 V/DIV — D.T.M.: 6.50

5 ms/DIV


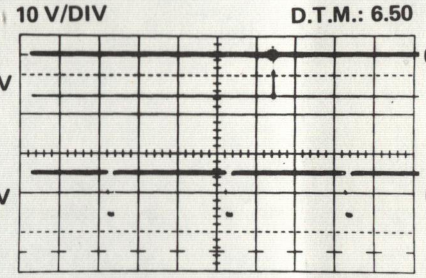
20 µs/DIV

3 — 200 mV/DIV — D.T.M.: 6.50

5 ms/DIV


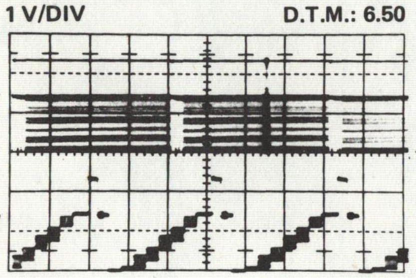
20 µs/DIV

7 — 10 V/DIV — D.T.M.: 6.50

5 ms/DIV


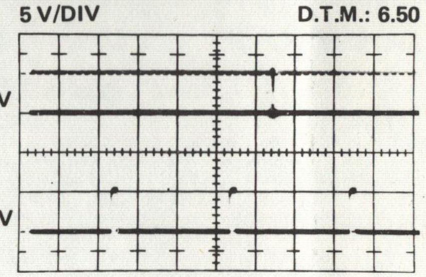
20 µs/DIV

4 — 1 V/DIV — D.T.M.: 6.50

5 ms/DIV


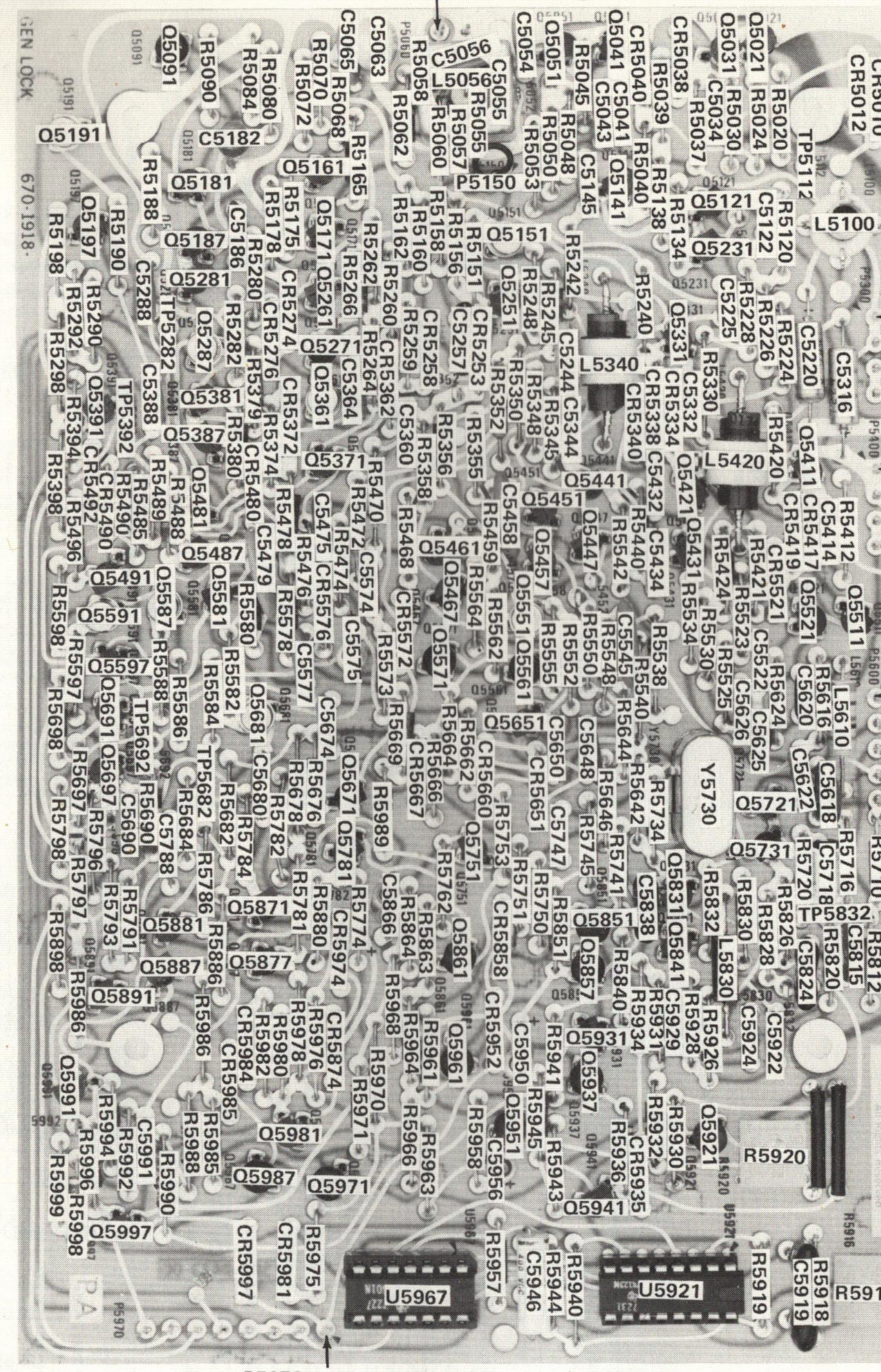
20 µs/DIV

8 — 5 V/DIV — D.T.M.: 6.50

5 ms/DIV


20 µs/DIV

Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.

P5060-


A5 – GEN LOCK circuit board

SYNC STRIP & CHROMA AMP

5

a

CHROMA AMPLIFIER

C5034
C5041
C5043
C5054
C5055

C5122
C5145
C5225

CR5010
CR5012
CR5038
CR5040

L5056
L5100

Q5021
Q5031
Q5041
Q5051
Q5121

Q5141
Q5231

R5020
R5024
R5030
R5037
R5039

R5040
R5045
R5048
R5050
R5053

R5055
R5057
R5120
R5134
R5138

R5224
R5226
R5228
R5242

TP5052
TP5112
TP5122

SYNC SEPARATOR

C5056
C5063
C5065
C5182
C5186

C5288
C5364

CR5274
CR5276
CR5362
CR6372
CR5480

Q5091
Q5161
Q5171
Q5181
Q5187

Q5261
Q5271
Q5281
Q5287
Q5361

Q5371
Q5381
Q5387
Q5481

R5038
R5058
R5060
R5062
R6068

R5070
R5072
R5080
R5084
R5090

R5165
R5175
R5178
R5188
R5260

R5262
R5264
R5266
R5280
R5282

R5374
R5379
R5380
R5476
R5478

TP5282

SOUND IN SYNC INHIBIT

C5919
C5946

CR5981

R5916
R5918
R5919
R5940
R5944

R5957
R5975

U5921A
U5921B
U5967A
U5967B
U5967C

BACK PORCH GENERATOR

C5257

CR5253
CR5258

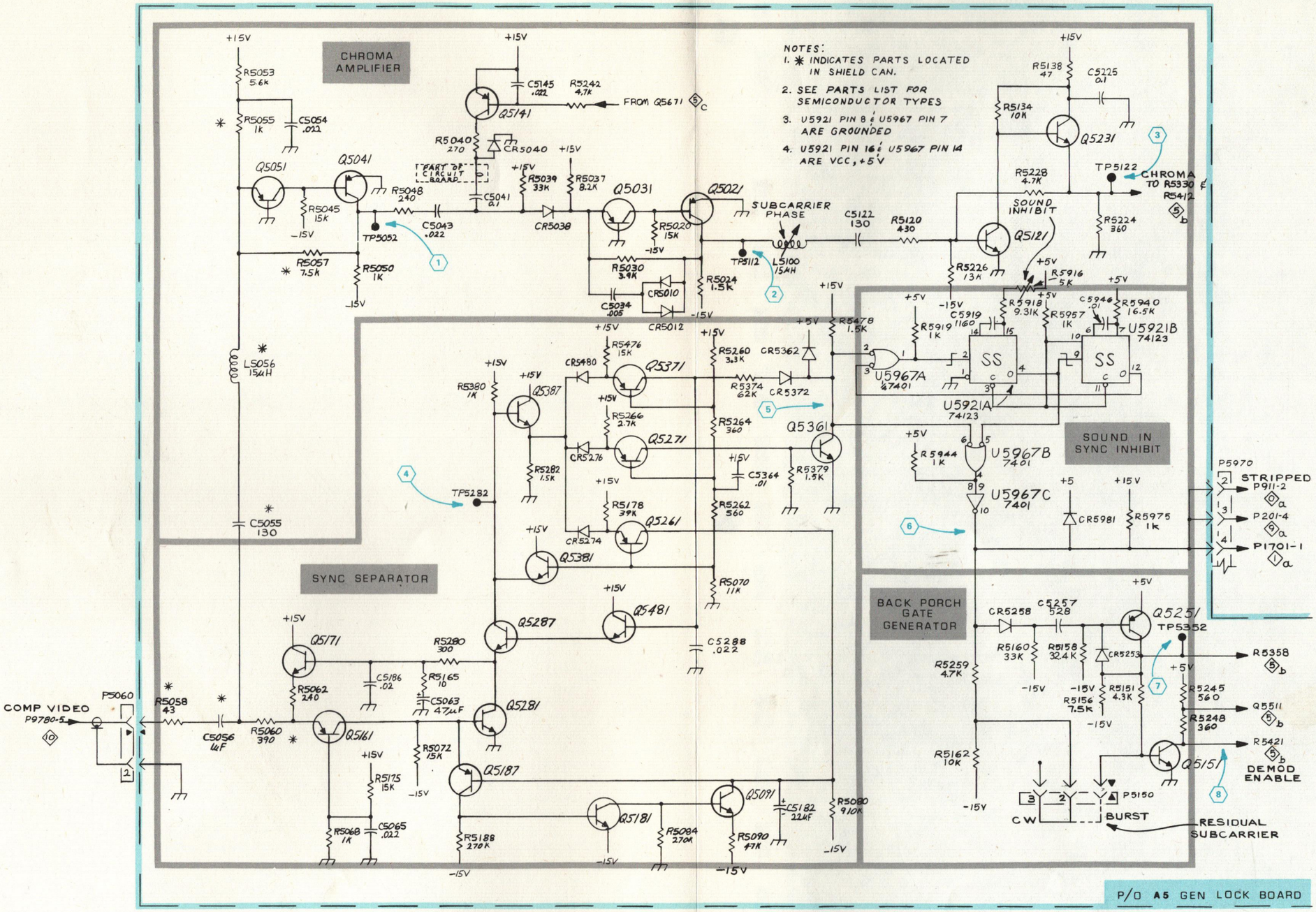
P5150

Q5151
Q5251

R5151
R5156
R5158
R5160
R5162

R5245
R5248
R5159

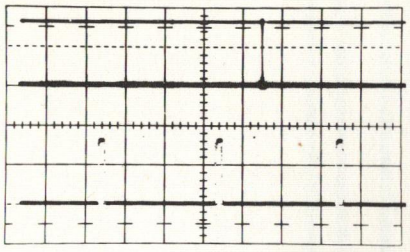
TP5352



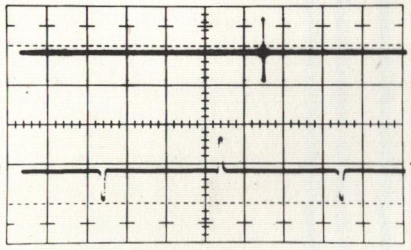
SYNC STRIP & CHROMA AMP 5a 12-74

5 b

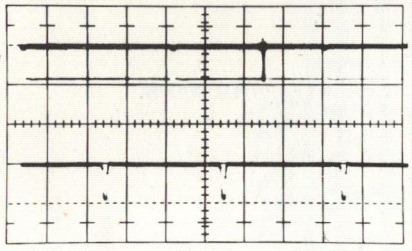
1
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



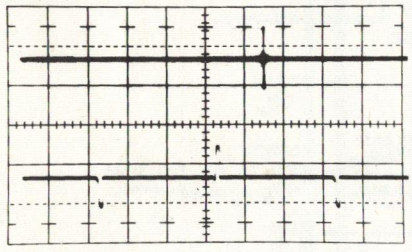
2
2 V/DIV D.T.M.: 6.50
5 ms/DIV
−4 V
20 µs/DIV
−4 V



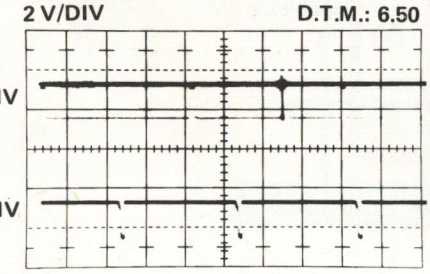
3
2 V/DIV D.T.M.: 6.50
5 ms/DIV
−4 V
20 µs/DIV
−4 V



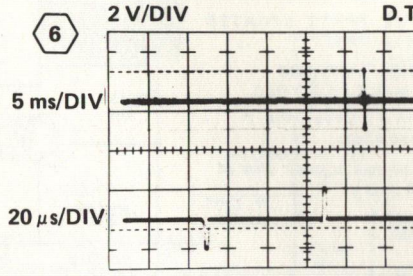
4
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



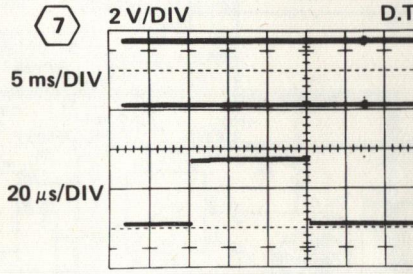
5
2 V/DIV D.T.M.: 6.50
20 µs/DIV
0 V
5 ms/DIV
0 V



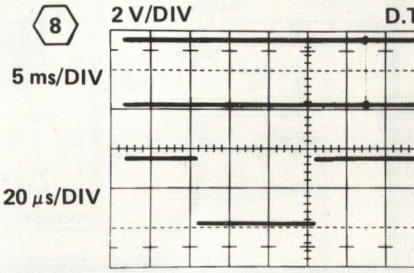
6
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



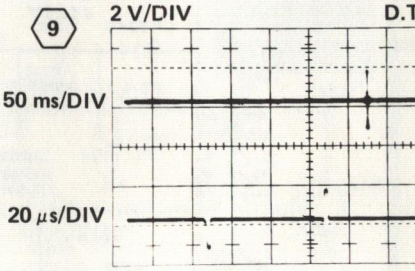
7
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



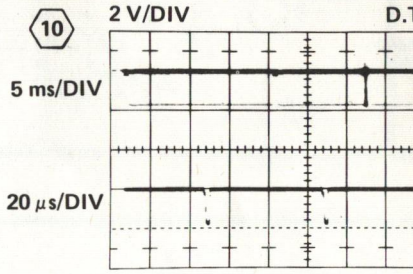
8
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



9
2 V/DIV D.T.M.: 6.50
50 ms/DIV
0 V
20 µs/DIV
0 V



10
2 V/DIV D.T.M.: 6.50
5 ms/DIV
0 V
20 µs/DIV
0 V



Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.

QUADRATURE DEMODULATORS

◇5◇ b

DEMODULATOR DRIVER

C5522
C5618
C5620
C5622
C5625
C5626

L5610
Q5421
Q5431
Q5511
Q5521

R5421
R5424
R5523
R5525
R5534

R5530
R5616
R5624

TP5332

BURST RECTIFIERS

C5360
C5475
C5574
C5648
C5650

CR5572
CR5576
CR5651
CR5660

Q5461
Q5651

R5460
R5468
R5470
R5472
R5474

R5536
R5538
R5540
R5552
R5564

R5573
R5644
R5664
R5666

PAL SWITCHER

C5220
C5316
C5479
C5575

CR5667

Q5597
Q5691

R5578
R5580
R5697

R5798
R5896
R5898

BURST LOCK DISABLE

CR5490
CR5492

Q5487

R5488
R5489

V BURST CLAMP

C5674
C5690

Q5561
Q5587
Q5591
Q5697
Q5891
Q5991

R5555
R5586
R5588
R5597
R5598

R5662
R5690
R5791
R5793
R5796
R5994

TP5682
TP5692
TP5992

PAL RESET

C5991

Q5997

R5992
R5996
R5998
R5999

BACK PORCH CLAMP

C5458
C5545

Q5467
Q5551

R5356
R5358
R5459
R5548

DEMODULATORS

C5244
C5332
C5344
C5414
C5432
C5434

CR5334
CR5338
CR5340
CR5417
CR5419
CR5521

L5340
L5420

Q5331
Q5411
Q5441
Q5447
Q5451
Q5457

R5240
R5330
R5345
R5348
R5350

R5352
R5355
R5420
R5412
R5440

R5542
R5550

TP5452
TP5458

U BURST CLAMP

C5388
C5577

Q5191
Q5197
Q5391
Q5491
Q5571
Q5681

R5190
R5198
R5290
R5292
R5298

R5394
R5398
R5490
R5496
R5562

R5582
R5584
R5669

TP5392
TP5698

NOTE:
SEE PARTS LIST FOR SEMICONDUCTOR TYPES

WAVEFORMS

CW SUBCARRIER 9 P298-5

MOD PULSE PHASE 135° P8100-4

MOD PULSE PHASE 225° P8100-5

P5600

P5970

DEMODULATOR DRIVER

BURST RECTIFIERS

PAL SWITCHER

DEMODULATOR

V BURST CLAMP

BURST LOCK DISABLE

PAL RESET

BACK PORCH CLAMPS

U BURST CLAMP

Q5231 5a CHROMA

Q5151 5a DEMODULATOR ENABLE

Q5251 5a BACK PORCH GATE

TO R5684 5c

TO R5784 R5751 5c

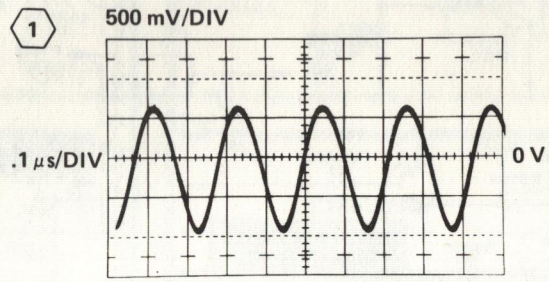
P5970 LOW FOR NON SYNC P398-7 9a

P5970 BURST LOCK ENABLE P8600-3 8

P/O A5 GEN LOCK BOARD

5

C



Voltage and Waveform obtained under conditions given on back side of Section 8 Title page except test oscilloscope internally triggered.

SUBCARRIER OSCILLATOR & FREQUENCY CONTROL

5 C

SUBCARRIER OSCILLATOR

C5718
C5815
C5824
C5838
C5922

C5924
C5929

CR5931

L5830

Q5721
Q5731
Q5831
Q5841

R5642
R5710
R5716
R5720
R5734

R5812
R5820
R5826
R5830
R5828

R5832
R5926
R5928
R5934

TP5832
Y5730

FREQUENCY CONTROL

C5680
C5747
C5788
C5866
C5950
C5956

CR5858
CR5874
CR5935
CR5952
CR5974

CR5984
CR5985
CR5997

Q5671
Q5751
Q5781
Q5851
Q5857

Q5871
Q5877
Q5861
Q5881
Q5887

Q5921
Q5931
Q5937
Q5941
Q5951

Q5961
Q5971
Q5981
Q5987

R5646
R5767
R5678
R5682
R5684

R5741
R5745
R5750
R5751
R5753

R5762
R5774
R5781
R5782
R5784

R5786
R5840
R5841
R5851
R5863

R5864
R5880
R5886
R5910
R5912

R5920
R5930
R5932
R5936
R5941

T5943
R5945
R5958
R5961
R5963

R5964
R5966
R5968
R5970
R5971

R5976
R5978
R5980
R5982
R5985

R5986
R5988
R5989
R5990

TP5782

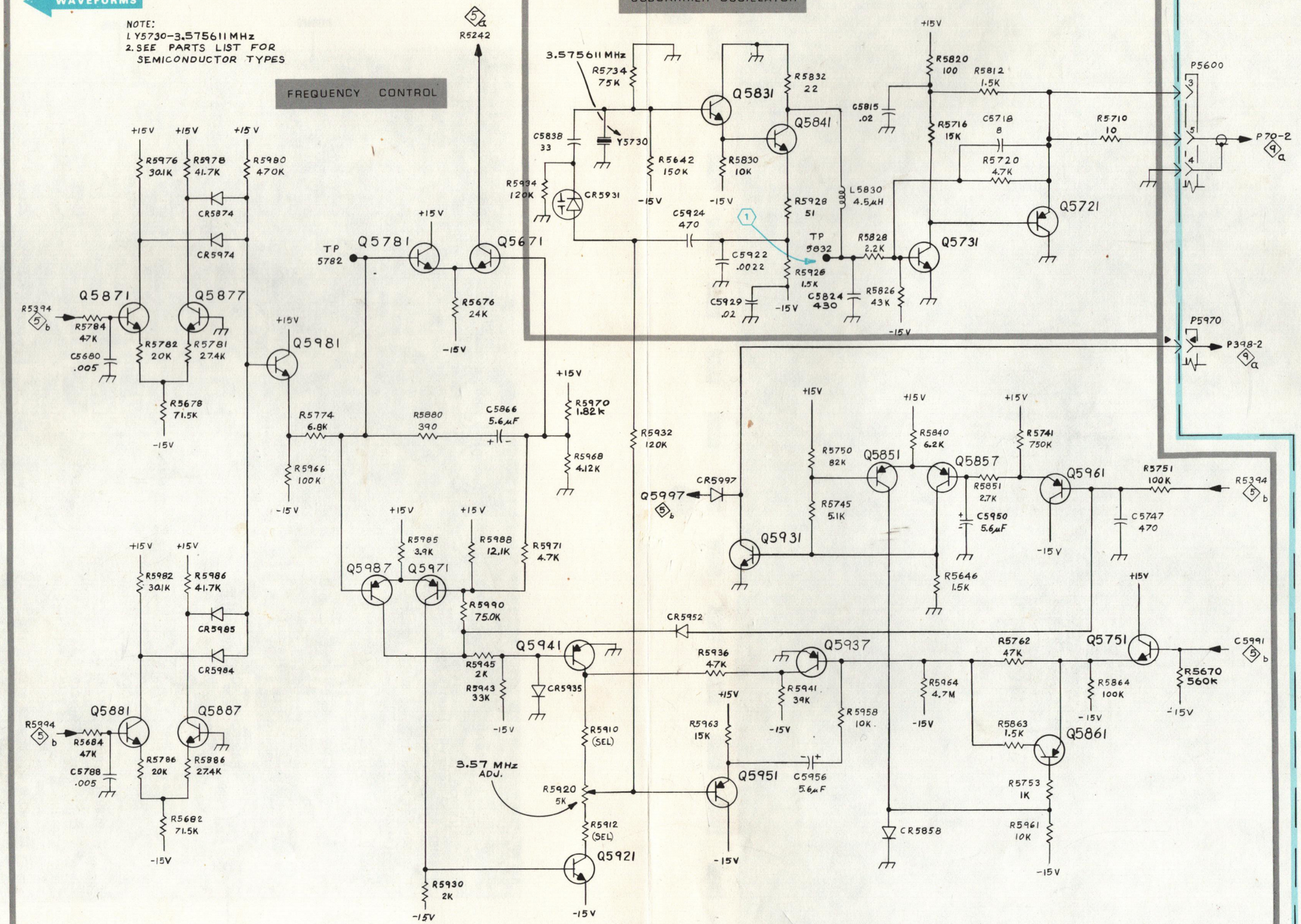
Y5730

WAVEFORMS

NOTE:
1. Y5730-3.575611 MHz
2. SEE PARTS LIST FOR SEMICONDUCTOR TYPES

FREQUENCY CONTROL

SUBCARRIER OSCILLATOR



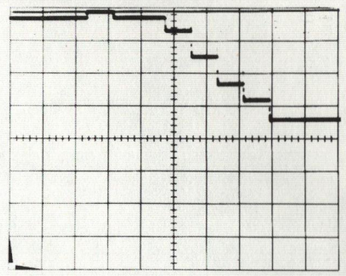
P/O A5 GEN LOCK BOARD

SUBCARRIER OSC & FREQENCY CONTROL 5c 12-74

6 a

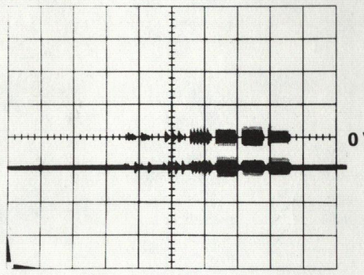
1 2V/DIV

5 µs/DIV 0 V



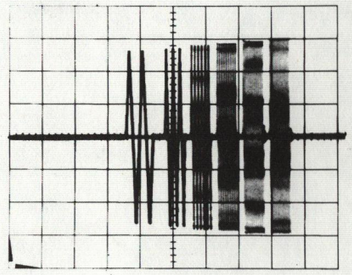
2 5V/DIV

5 µs/DIV 0 V

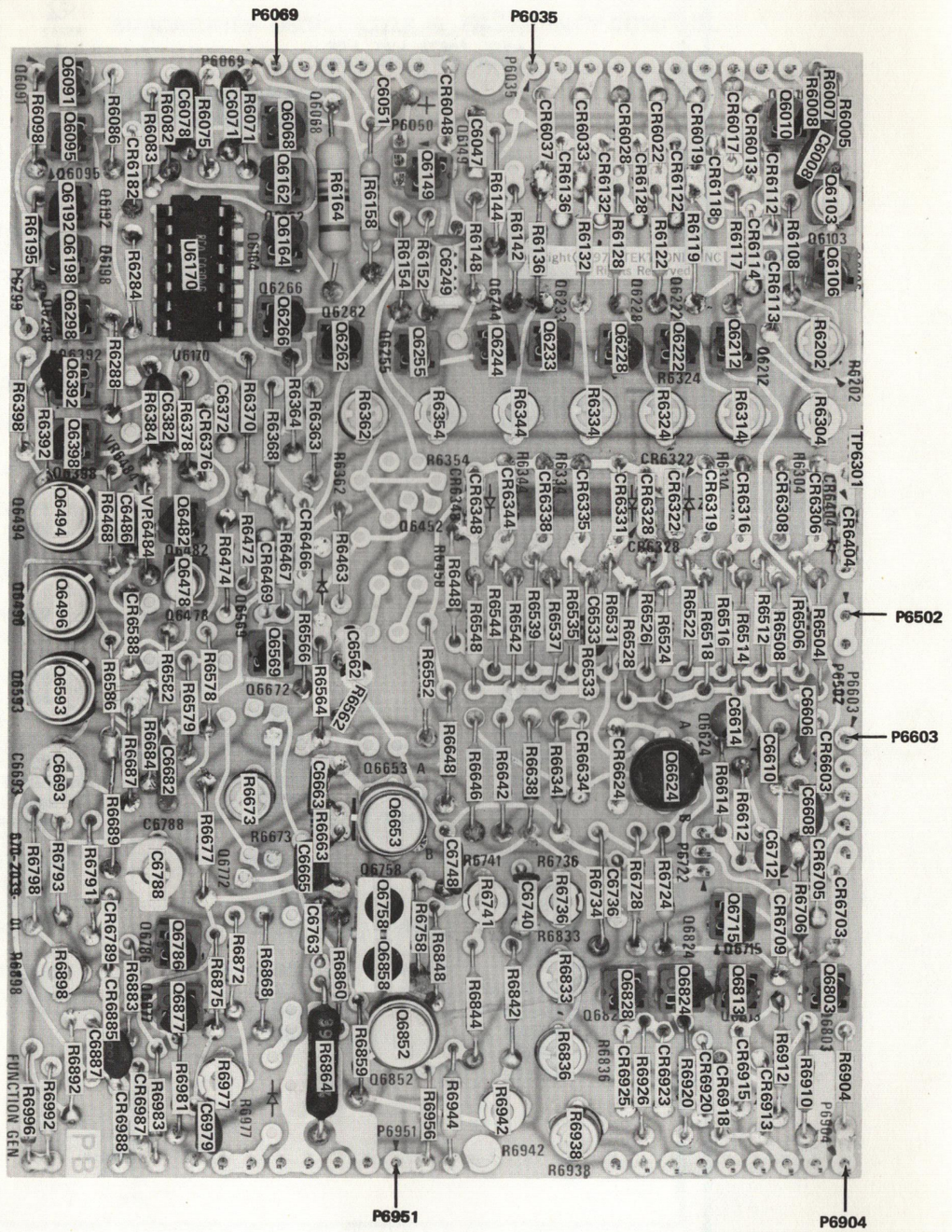


3 2V/DIV

5 µs/DIV 0 V



Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page except FULL FIELD SIG switch set to CCIR-II.



A6 FUNCTION GENERATOR BOARD

FUNCTION GENERATOR

6 a

MB ENABLE

C6008

CR6017
CR6112
CR6114

Q6010
Q6103

R6005
R6007
R6008
R6108

STOP LEVEL

C6048
C6562

CR6948

Q6149
Q6569

R6463
R6467
R6562
R6566
R6673

R6677
R6689

MULTIBURST RATE CONTROL

CR6013
CR6019
CR6022
CR6028
CR6033

CR6037
CR6113
CR6118
CR6122
CR6128

CR6132
CR6136
CR6466

Q6160
Q6164
Q6212
Q6222
Q6228

Q6233
Q6244
Q6262
Q6266

R6117
R6119
R6122
R6128
R6132

R6136
R6142
R6148
R6154
R6144

R6158
R6164
R6202
R6304
R6314

R6324
R6334
R6344
R6354
R6362

R6363
R6364

STOP CONTROL

CR6469

Q6091
Q6095
Q6192
Q6198
Q6298
Q6392

R6086
R6098
R6195
R6284
R6288

R6384
R6392
R6398
R6472

POWER SUPPLY

C6047
C6051
C6372
C6606
C6665

Q6255

R6152

TRIANGLE LEVEL DETECTOR

C6693
C6788
C6887
C6979

CR6182
CR6789
CR6885
CR6987
CR6988

Q6786
Q6877

R6474
R6791
R6793
R6798
R6869

R6872
R6875
R6981
R6883
R6892

R6898
R6977
R6983
R6992

TRIANGLE GENERATOR

C6078
C6382
C6486
C6682

CR6376
CR6588

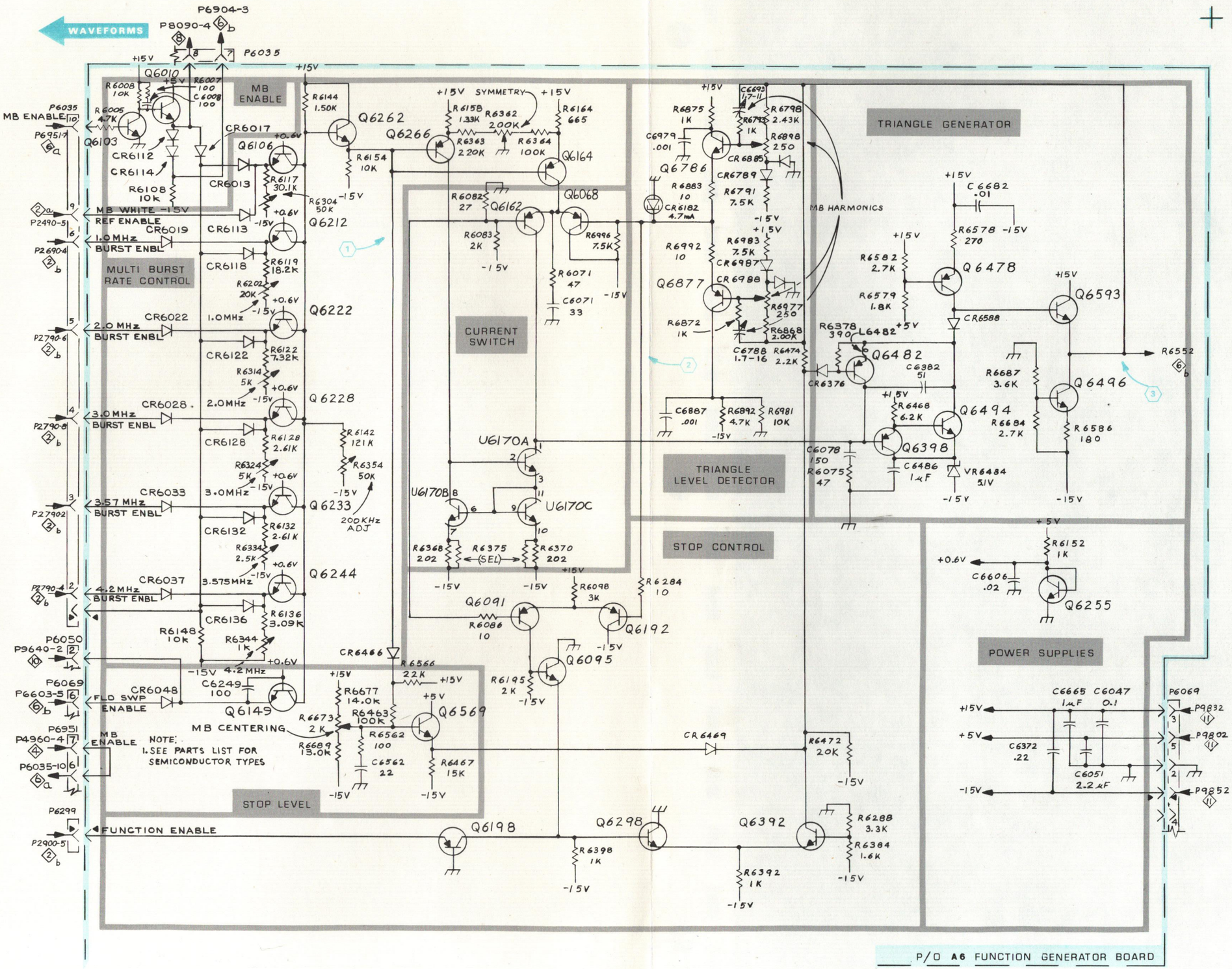
L6482

Q6398
Q6478
Q6482
Q6494
Q6496
Q6593

R6075
R6378
R6468
R6578
R6579

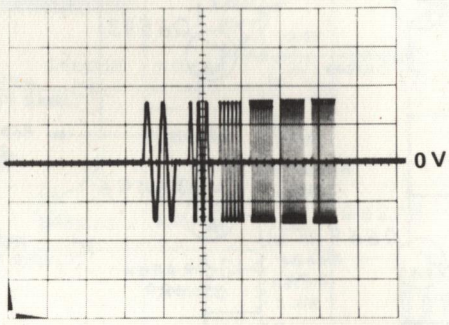
R6582
R6586
R6684
R6687

VR6484


WAVEFORMS
P6904-3
P8090-4
P6035
MB ENABLE
MB WHITE -15V
REF ENABLE
1.0MHz BURST ENBL
2.0 MHz BURST ENBL
3.0MHz BURST ENBL
3.57 MHz BURST ENBL
4.2MHz BURST ENBL
FLD SWP ENABLE
FUNCTION ENABLE
MULTI BURST RATE CONTROL
CURRENT SWITCH
TRIANGLE GENERATOR
TRIANGLE LEVEL DETECTOR
STOP CONTROL
STOP LEVEL
POWER SUPPLIES
MB HARMONICS
MB CENTERING
SYMMETRY
NOTE:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
P/O A6 FUNCTION GENERATOR BOARD

6 b

1 2V/DIV



Voltage and Waveform obtained under conditions given on back side of Section 8 Title page except FULL FIELD SIG switch set to CCIR-II.

NOISE & MULTIBURST PEDESTALS

6 b

DIODE SHAPER

C6508
C6533
C6614
C6712

CR6306
CR6308
CR6316
CR6318
CR6322

CR6328
CR6331
CR6335
CR6338
CR6344

CR6348
CR6404
CR6624
CR6634

Q6624A
Q6624B

R6448
R6504
R6506
R6508
R6512

R6514
R6516
R6518
R6522
R6524

R6526
R6528
R6531
R6533
R6535

R6537
R6539
R6542
R6544
R6548

R6552
R6612
R6614
R6634
R6638

R6642
R6646
R6648

TP6301

NOISE AMPLIFIER

C6608
C6610

CR6603
CR6703
CR6705
CR6709

Q6715
Q6803

R6706
R6724
R6728
R6734
R6904

AMPLIFIER

C6663
C6740
C6748
C6763

L6852
Q6653A
Q6653B
Q6758
Q6852
Q6858

R6663
R6736
R6741
R6758
R6842

R6844
R6848
R6859
R6860
R6864

R6942
R6944
R6956

MULTIBURST PEDESTAL

C6736

CR6913
CR6915
CR6918
CR6920
CR6923
CR6925

Q6813
Q6824
Q6828

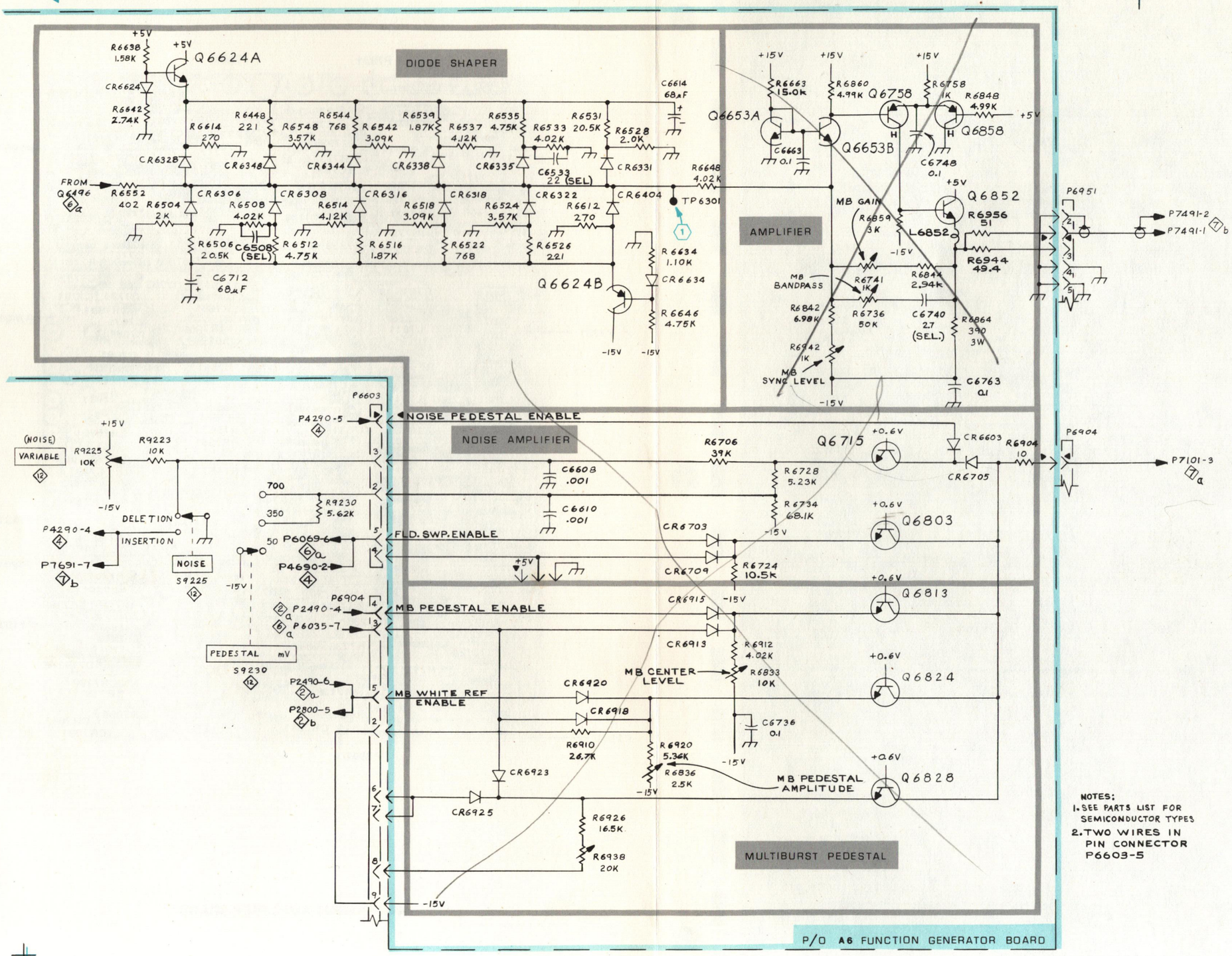
R6833
R6836
R6910
R6912
R6920

R6926
R6938

OFF BOARD COMPONENTS

R9223
R9225
R9230

S9225
S9230



NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. TWO WIRES IN PIN CONNECTOR P6603-5

7 a

1 1V/DIV

10 µs/DIV

0 V

2 1V/DIV

10 µs/DIV

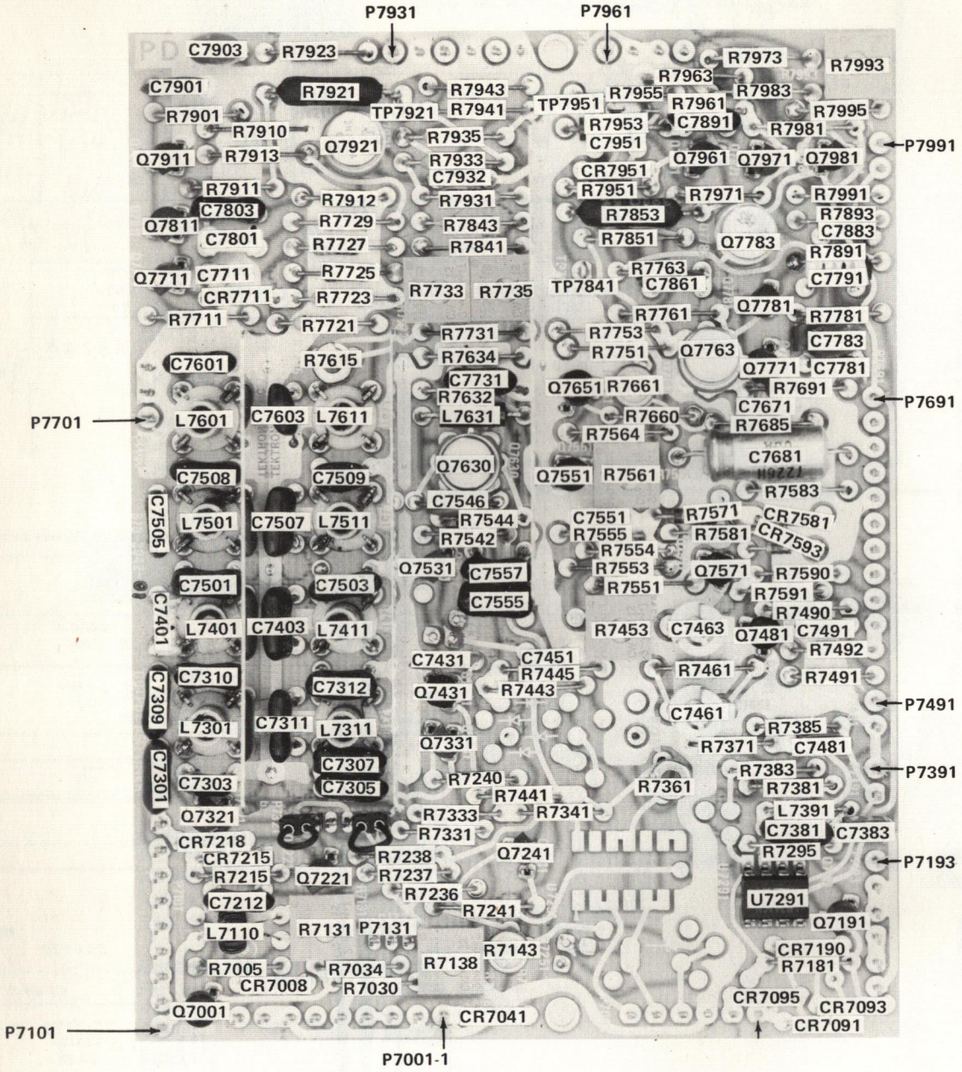
0 V

3 .2V/DIV

10 µs/DIV

+4.2V

Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.



A7 OUTPUT AMPLIFIER BOARD

FILTERS

◇7a

PULSE GENERATOR

C7212

CR7008
CR7215
CR7218

L7110

P7131

Q7001
Q7221

R7005
R7030
R7034
R7131
R7138

R7215
R7236
R7237
R7238

BAR GENERATOR

C7451
C7883
C7903

CR7041

Q7241
Q7531

R7143
R7241
R7542

MODULATED PULSE LUMINANCE AMPLIFIER

C7546

Q7630A

R7443
R7445
R7453
R7544

2.5 V BIAS SUPPLY

C7783
C7932

Q7630B

R7632
R7634

FILTER

C7301
C7303
C7305
C7307
C7309

C7310
C7311
C7312
C7401
C7403

C7431
C7501
C7503
C7505
C7507

C7508
C7509
C7533
C7555
C7601

C7603
C7731

L7301
L7311
L7401
L7411
L7501

L7511
L7601
L7611
L7631
L7321

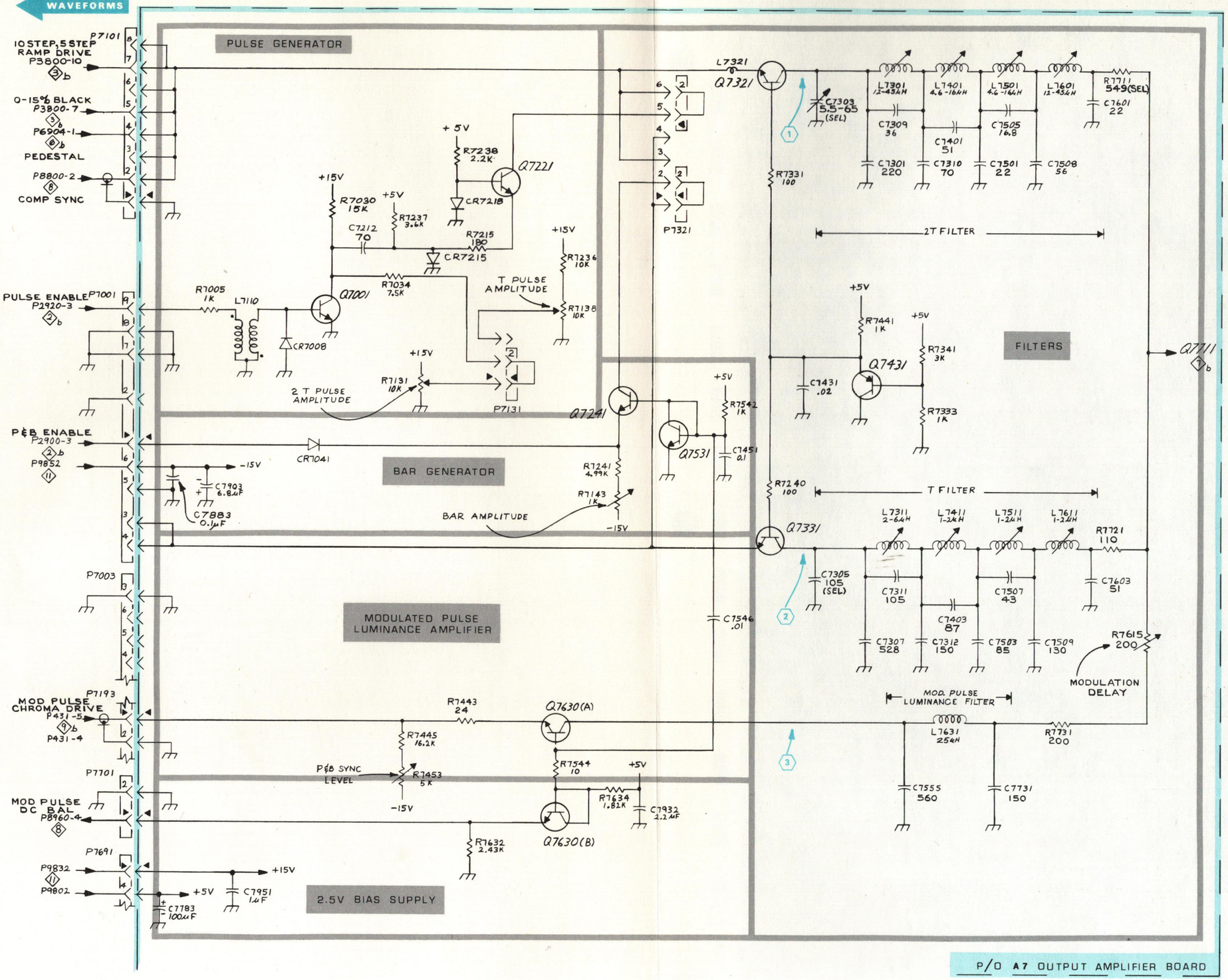
P7321

Q7321
Q7331
Q7431

R7240
R7331
R7333
R7341
R7441

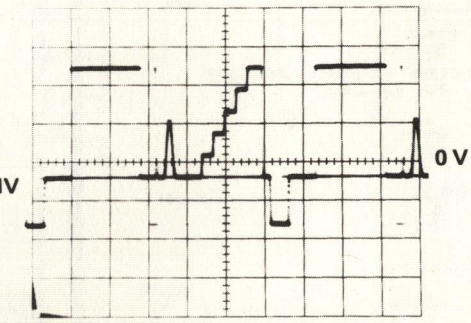
R7615
R7711
R7721
R7731

@

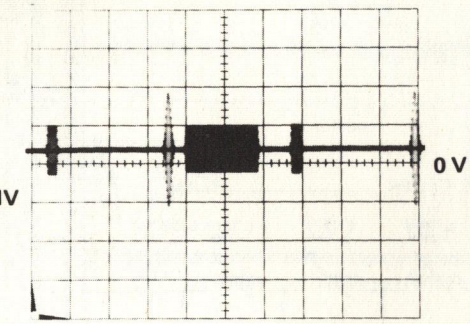

PULSE GENERATOR
BAR GENERATOR
MODULATED PULSE LUMINANCE AMPLIFIER
2.5V BIAS SUPPLY
FILTERS
P7101
10 STEP, 5 STEP RAMP DRIVE P3800-10
0-15% BLACK P3800-7
P6904-1
PEDESTAL
P8800-2
COMP SYNC
PULSE ENABLE P2920-3
P&B ENABLE P2900-3
P9852
P7001
P7003
P7193
MOD PULSE CHROMA DRIVE P431-5
P431-4
P7701
MOD PULSE DC BAL P8960-4
P7691
P9832
P9802
+5V
+15V
-15V
R7030 15K
R7238 2.2K
Q7221
CR7218
C7212 70
R7237 3.6K
R7215 180
CR7215
R7236 10K
R7138 10K
T PULSE AMPLITUDE
R7034 7.5K
Q7001
R7005 1K
L7110
CR7008
R7131 10K
2 T PULSE AMPLITUDE
P7131
CR7041
C7903 6.8µF
C7883 0.1µF
R7241 4.99K
R7143 1K
BAR AMPLITUDE
Q7241
Q7531
R7542 1K
C7451 0.1
C7546 .01
L7321
Q7321
C7303 5.5-65 (SEL)
P7321
R7331 100
L7301 12-45nH
L7401 4.6-16nH
L7501 4.6-16nH
L7601 12-45nH
R7711 549(SEL)
C7309 36
C7401 51
C7505 16.8
C7601 22
C7301 220
C7310 70
C7501 22
C7508 56
2T FILTER
R7441 1K
R7341 3K
Q7431
C7431 .02
R7333 1K
Q7711
R7240 100
T FILTER
Q7331
L7311 2-6nH
L7411 1-2nH
L7511 1-2nH
L7611 1-2nH
R7721 110
C7305 105 (SEL)
C7311 105
C7403 87
C7507 43
C7603 51
C7307 528
C7312 150
C7503 85
C7509 130
R7615 200
MODULATION DELAY
MOD. PULSE LUMINANCE FILTER
L7631 25nH
R7731 200
C7555 560
C7731 150
R7443 24
Q7630(A)
R7445 16.2K
P&B SYNC LEVEL
R7453 5K
R7544 10
R7634 1.82K
C7932 2.2µF
Q7630(B)
R7632 2.43K
C7951 1µF
C7783 100µF
P/O A7 OUTPUT AMPLIFIER BOARD

7 b

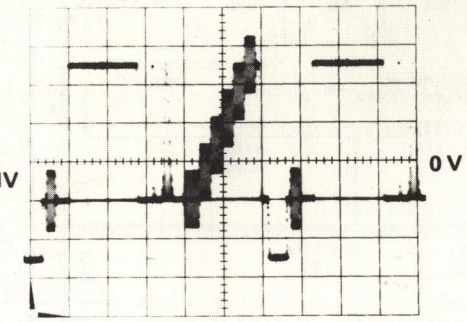
1 1V/DIV



2 1V/DIV



3 .2V/DIV



Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.

OUTPUT AMPLIFIER

◇7 b

LUMINANCE AMPLIFIER

C7711
C7801
C7803
C7901

CR7711

Q7711
Q7811
Q7911
Q7921

R7723
R7725
R7729
R7733

R7735
R7841
R7843
R7901
R7911

R7912
R7913
R7915
R7921
R7923

R7931
R7933
R7935
R7941
R7943

TP7921

OFF BOARD COMPONENTS

J9006
J9011
J9250

CHROMINANCE AMPLIFIER

C7452
C7461
C7463
C7491
C7551

C7575
C7671
C7681
C7781
C7791
C7861

CR7491
CR7581
CR7593

Q7481
Q7551
Q7571
Q7651
Q7763A

Q7763B
Q7771
Q7781
Q7783

R7452
R7461
R7490
R7491
R7492

R7551
R7553
R7554
R7555
R7561

R7564
R7571
R7575
R7581
R7583

R7590
R7591
R7660
R7661
R7685

R7691
R7751
R7753
R7761
R7763

R7771
R7851
R7853
R7891

TP7841

VITS AMPLIFIER CLAMP

C7381
C7383
C7481

CR7091
CR7093
CR7095
CR7190
L7391

Q7191

R7181
R7361
R7371
R7381
R7383

R7385
R7981
R7991

U7291

EXT VITS AMPLIFIER

C7891

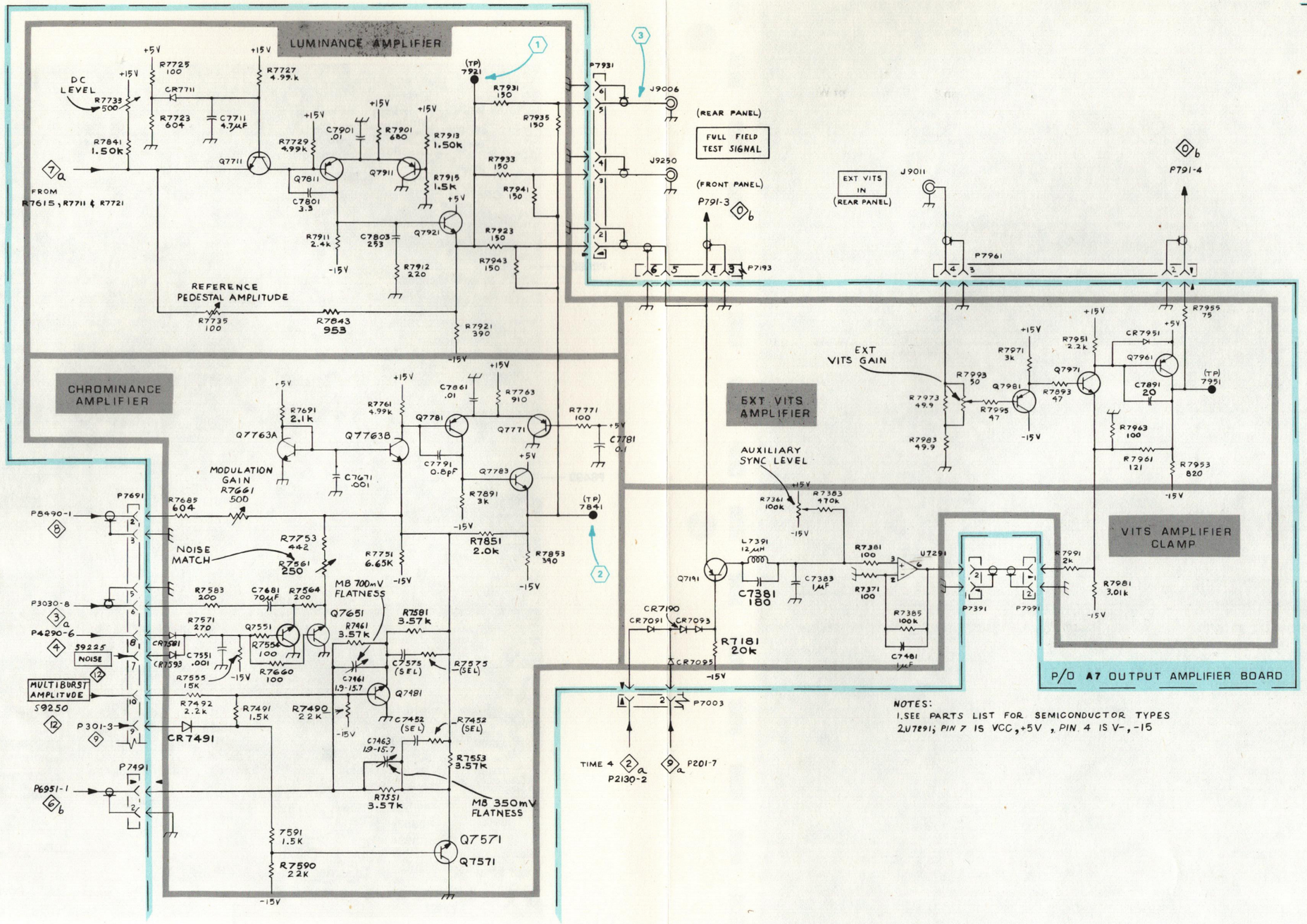
CR7951

Q7961
Q7971
Q7981

R7893
R7951
R7953
R7955
R7961

R7963
R7971
R7973
R7983
R7993
R7995

TP7951



NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. U7291; PIN 7 IS VCC, +5V, PIN 4 IS V-, -15

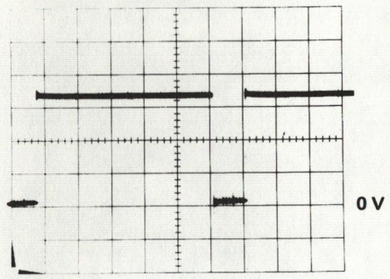
8

1

1 V/DIV

10 µs/DIV

0 V

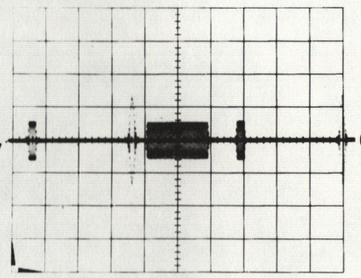


3

.5 V/DIV

10 µs/DIV

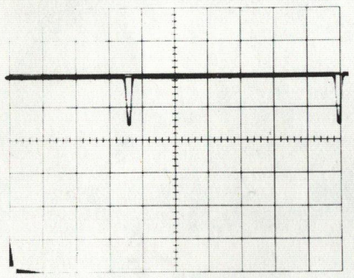
0 V



2

10 µs/DIV

0 V

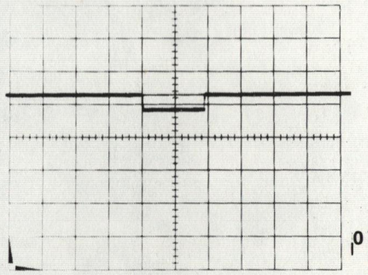


4

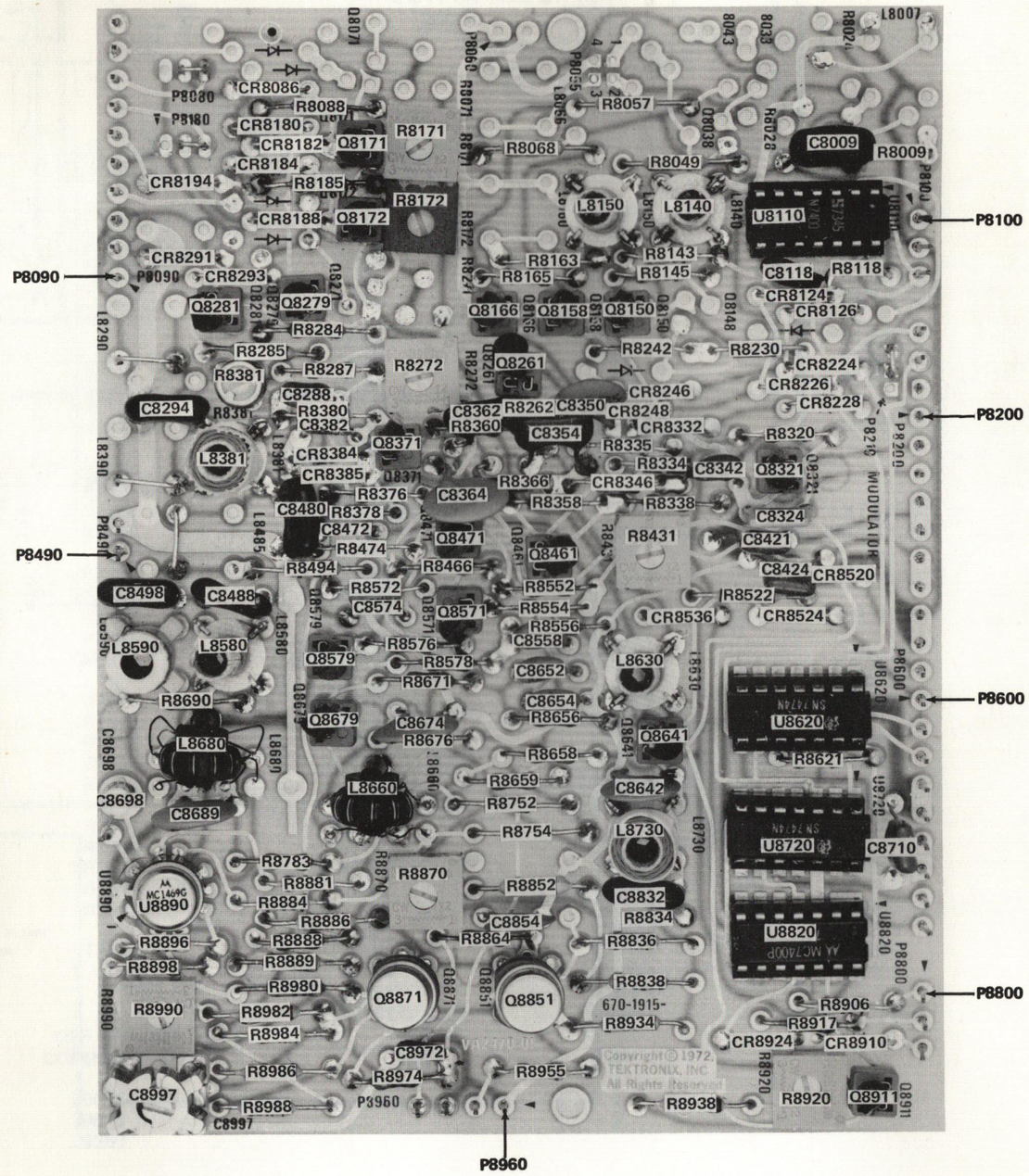
1V/DIV

10 µs/DIV

0 V



Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page except Waveforms (1) and (2) test oscilloscope internally triggered.



A8 MODULATOR BOARD

MODULATOR

8

SUBCARRIER PHASE CONTROL

C8009
C8118
C8288
C8342
C8350

C8354
C8362
C8364
C8382
C8421

CR8124
CR8126
CR8224
CR8226
CR8228

CR8246
CR8248
CR8332
CR8346
CR8384
CR8385

L8140
L8150
L8630

Q8150
Q8158
Q8166
Q8261
Q8371

R8009
R8049
R8057
R8068
R8118

R8143
R8145
R8163
R8165
R8230

R8262
R8287
R8334
R8335
R8360

R8366
R8376
R8378
R8380

U8110C
U8110D

SUBCARRIER AMPLIFIER

C8424
C8472
C8558
C8574
C8652
C8654

Q8461
Q8471
Q8571
Q8579
Q8679

R8338
R8358
R8466
R8474
R8552

R8554
R8556
R8572
R8576
R8578

R8656
R8671

MODULATOR

C8674
C8689
C8698

L8660
L8680

R8658
R8659
R8676
R8752
R8754

R8783
R8881
R8884
R8888
R8889
R8980

U8890

BANDPASS FILTER

C8488
C8498

L8580
L8590

R8690

FULL FIELD SYNC

CR8910C
CR8924

Q8911

R8906
R8917
R8920
R8938

U8820D

MODULATOR DRIVE

C8294
C8324
C8480
C8642
C8832

C8854
C8972
C8997

CR8520
CR8524
CR8536

L8730
L8881

Q8321
Q8641
Q8851A
Q8851B
Q8871A
Q8871B

R8320
R8431
R8494
R8522
R8834

R8836
R8838
R8852
R8864
R8870

R8886
R8896
R8898
R8934
R8955
R8974

R8982
R8984
R8986
R8988
R8990

BRUCH BURST BLANKING

U8620A
U8720A
U8720B
U8820A
U8820B&C

R8621

CCIR-II CHROMA

C8710

CR8086
CR8180
CR8182
CR8184
CR8188
CR8194

Q8171
Q8172
Q8279

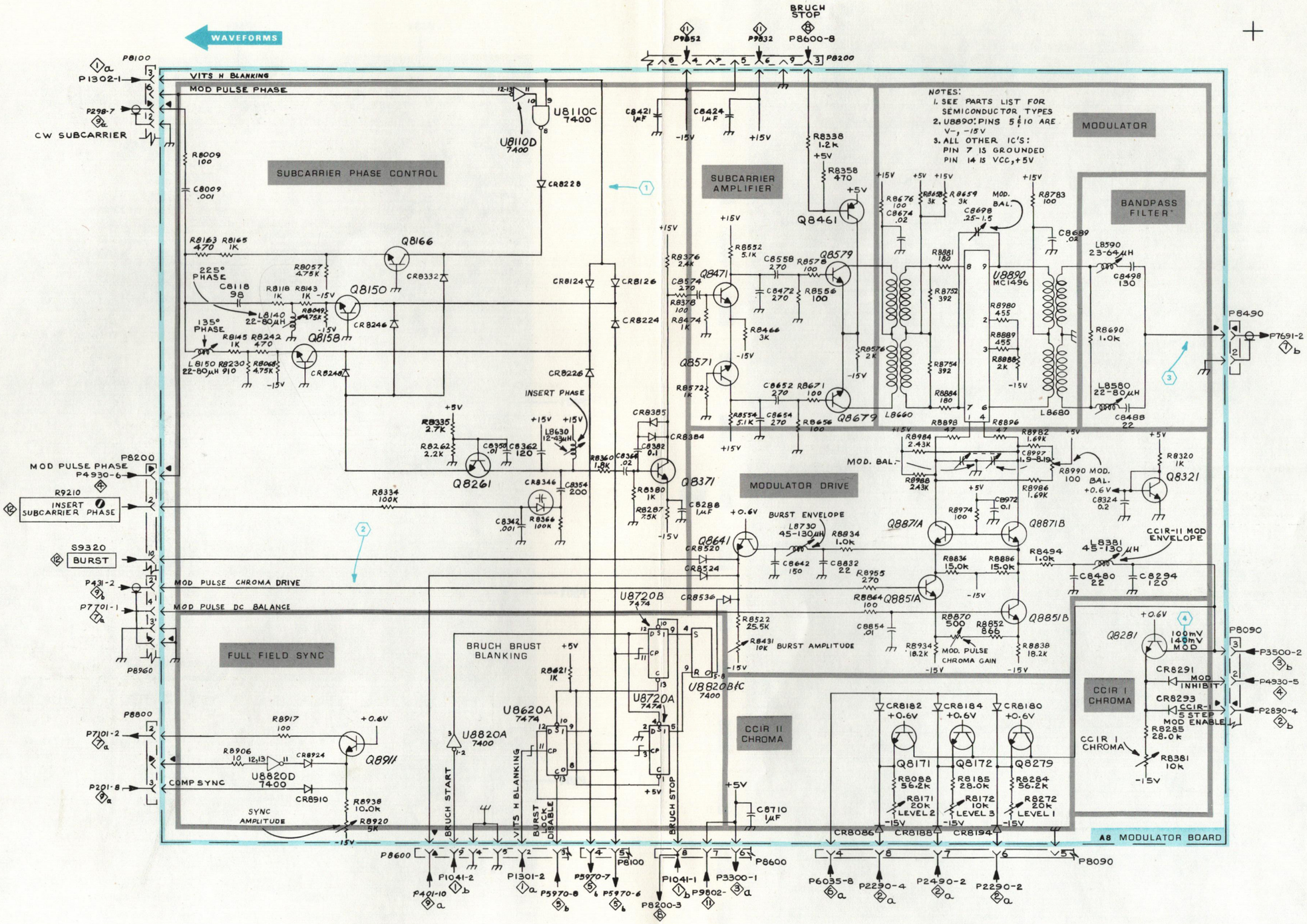
R8088
R8171
R8172
R8185
R8272
R8284

CCIR-I CHROMA

CR8291
CR8293

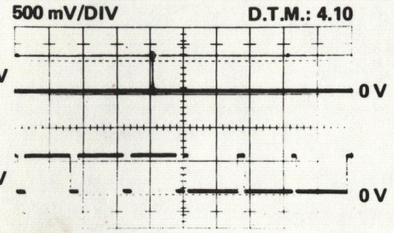
Q8281

R8285
R8381


WAVEFORMS
P8100
P1302-1
VITS H BLANKING
MOD PULSE PHASE
P298-7
CW SUBCARRIER
SUBCARRIER PHASE CONTROL
U8110C 7400
U8110D 7400
CR8228
R8009 100
C8009 .001
R8163 470
R8165 1K
Q8166
CR8332
225° PHASE
C8118 98
R8118 1K
R8143 1K
-15V
R8057 4.75K
Q8150
CR8246
135° PHASE
L8140 22-80µH
R8049 4.75K
Q8158
R8145 1K
R8242 470
L8150 22-80µH
R8230 910
R8068 4.75K
CR8248
CR8124
CR8126
CR8224
CR8226
INSERT PHASE
+5V
R8335 2.7K
R8262 2.2K
Q8261
+15V
L8630 12-43µH
C8350 .01
C8362 120
C8364 .02
R8360 1.8K
CR8385
CR8384
C8382 0.1
Q8371
R8380 1K
C8288 1µF
R8287 7.5K
MODULATOR DRIVE
P8200
MOD PULSE PHASE
P4930-6
R9210
INSERT SUBCARRIER PHASE
R8334 100K
CR8346
C8354 200
C8342 .001
R8366 100K
S9320
BURST
P431-2
MOD PULSE CHROMA DRIVE
P7701-1
MOD PULSE DC BALANCE
P8960
FULL FIELD SYNC
P8800
P7101-2
P201-8
COMP SYNC
R8917 100
+0.6V
Q8911
R8906 10
CR8924
U8820D 7400
CR8910
R8938 10.0K
R8920 5K
SYNC AMPLITUDE
BRUCH BRUST BLANKING
U8620A 7474
U8820A 7400
R8621 1K
U8720A 7474
U8820B&C 7400
BRUCH START
VITS H BLANKING
BURST GATE DISABLE
BRUCH STOP
C8710 1µF
P8600
P1041-2
P401-10
P1301-2
P5970-8
P5970-7
P5970-6
P8100
P1041-1
P9802-
P8200-3
P3300-1
P9852
P9832
BRUCH STOP
P8600-8
P8200
C8421 1µF
C8424 1µF
-15V
+15V
R8338 1.2K
+5V
R8358 470
Q8461
SUBCARRIER AMPLIFIER
R8376 2.4K
R8552 5.1K
C8558 270
R8578 100
Q8579
Q8471
C8574 270
R8378 100
R8474 1K
C8472 270
R8556 100
R8466 3K
Q8571
R8572 1K
C8652 270
R8671 100
Q8679
R8576 2K
R8554 5.1K
C8654 270
R8656 100
L8660
L8680
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. U8890: PINS 5 & 10 ARE V-, -15V
3. ALL OTHER IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V
MODULATOR
BANDPASS FILTER
R8676 100
C8674 .02
R8658 3K
R8659 3K
MOD. BAL.
C8698 .25-1.5
R8783 100
C8689 .02
R8881 180
U8890 MC1496
R8752 392
R8980 455
R8889 455
R8888 2K
R8754 392
R8884 180
L8590 23-64µH
C8498 130
R8690 1.0K
L8580 22-80µH
C8488 22
P8490
P7691-2
R8898 4.7
R8896 4.7
R8984 2.43K
R8988 243K
MOD. BAL.
R8982 1.69K
C8997 1.5-8.1p
R8990 MOD. BAL. 100
R8986 1.69K
R8320 1K
Q8321
C8324 0.2
C8972 0.1
R8974 100
Q8871A
Q8871B
CCIR-11 MOD ENVELOPE
L8381 45-130µH
R8494 1.0K
C8480 22
C8294 120
BURST ENVELOPE
L8730 45-130µH
R8834 1.0K
C8642 150
C8832 22
Q8641
CR8520
CR8524
R8955 270
R8864 100
Q8851A
Q8851B
R8836 15.0K
R8886 15.0K
R8870 500
R8852 866
R8934 18.2K
MOD. PULSE CHROMA GAIN
R8838 18.2K
U8720B 7474
CR8536
R8522 25.5K
R8431 10K
BURST AMPLITUDE
CCIR II CHROMA
CCIR I CHROMA
Q8281
100mV 140mV MOD
P8090
P3500-2
P4930-5
P2890-4
CR8291
MOD INHIBIT
CR8293
CCIR-I 5 STEP MOD ENABLE
R8285 28.0K
R8381 10K
CR8182
CR8184
CR8180
Q8171
Q8172
Q8279
R8088 56.2K
R8185 28.0K
R8284 56.2K
R8171 20K LEVEL 2
R8172 10K LEVEL 3
R8272 20K LEVEL 1
CR8186
CR8188
CR8194
P6035-8
P2290-4
P2490-2
P2290-2
P8090
A8 MODULATOR BOARD

9 a

1



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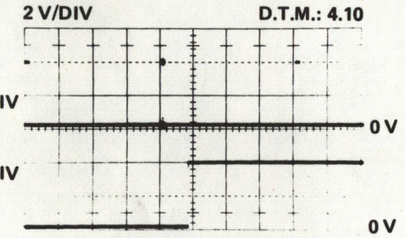

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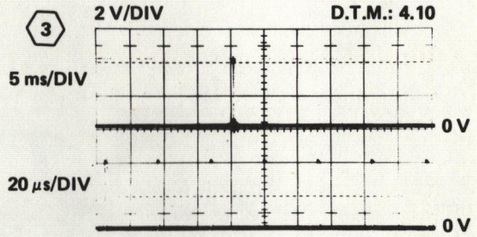

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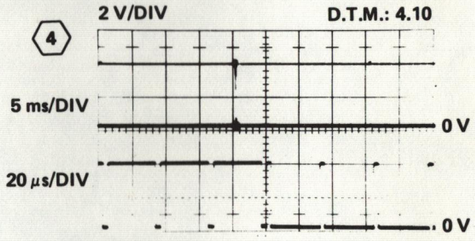

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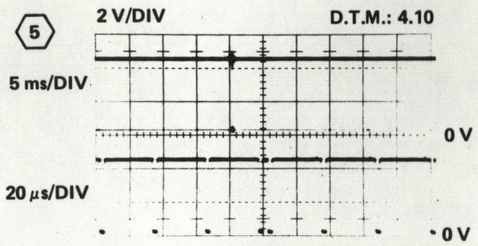
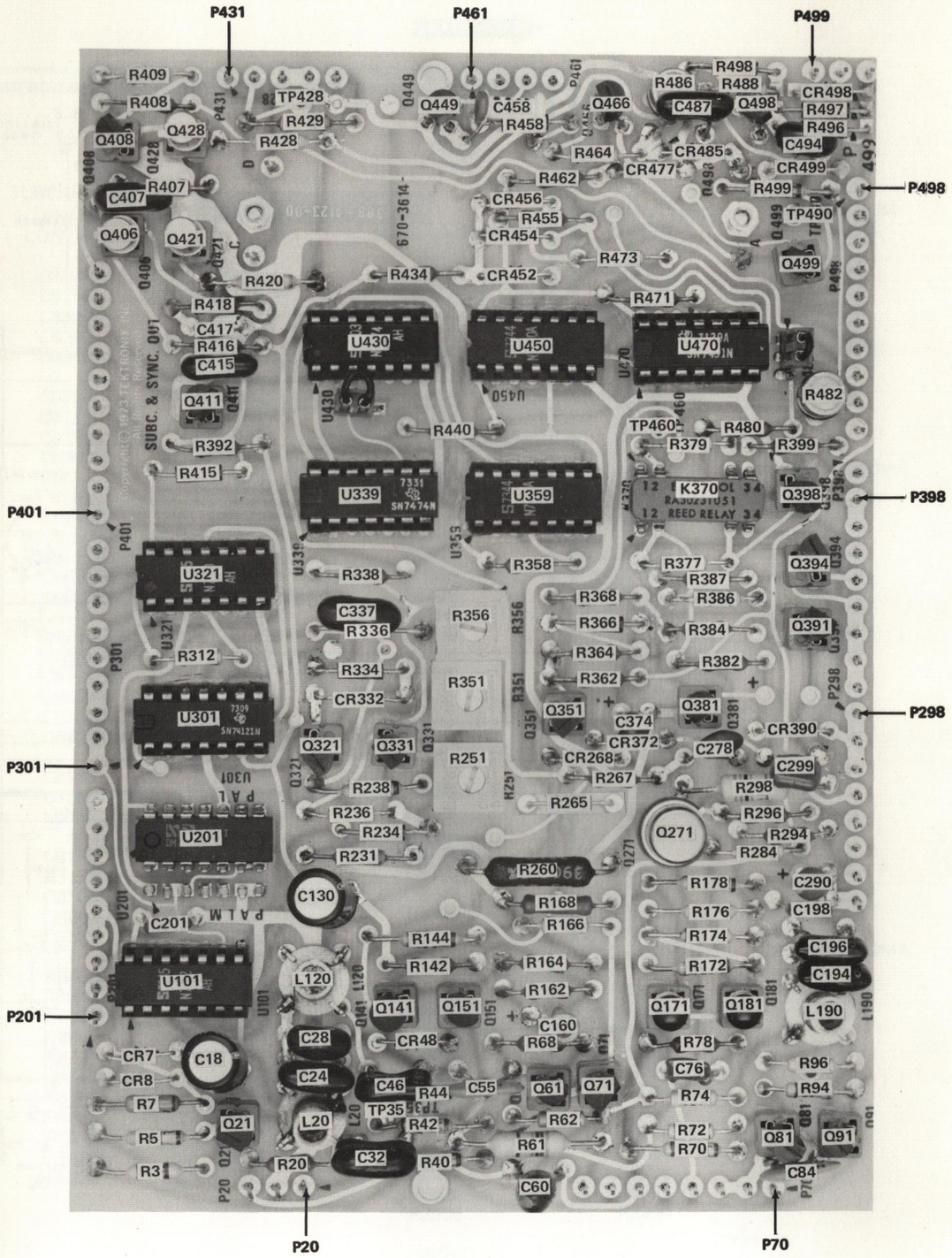


Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.



A9 SUBCARRIER & SYNC OUT BOARD

SYNC & SUBCARRIER OUTPUT AMPLIFIERS

9 a

COMP SYNC AMP

C18
C24
C28
C32
C46
C55
C160
C299

CR7
CR8
CR48
CR372
CR390

L20
L120

Q21
Q61
Q71
Q151
Q381

R3
R5
R7
R20
R40

R42
R44
R61
R62
R68

R142
R144
R162
R164
R166
R368
R382
R384

TP35

U101

SUBCARRIER AMPLIFIER

C76
C84
C130
C194
C196

C198
C201
C290

K370

L190

Q81
Q91
Q171
Q181
Q271
Q398

R70
R72
R74
R78
R94

R96
R168
R172
R174
R176
R178
R260
R284
R294
R296

R298
R379
R399
R480

VERT SYNC

U101C
U201
U321A

HORIZ SYNC

R312

U321B
U321C
U321D

REGENERATED SYNC TIMING

C337
CR332
Q321
Q331

R231
R234
R236
R238
R251

R265
R329
R334
R336
R351
R356

U101D
U301

OFF BOARD COMPONENTS

J9002
J9004

NON SYNC INHITIT

C278
C374

CR268

Q351
Q391
Q394

R267
R362
R364
R366
R386
R387

U101B

BURST KEY

C407
C415
C417

P481

Q406
Q408
Q421
Q528

R407
R408
R409
R415
R416

R418
R420
R428

@

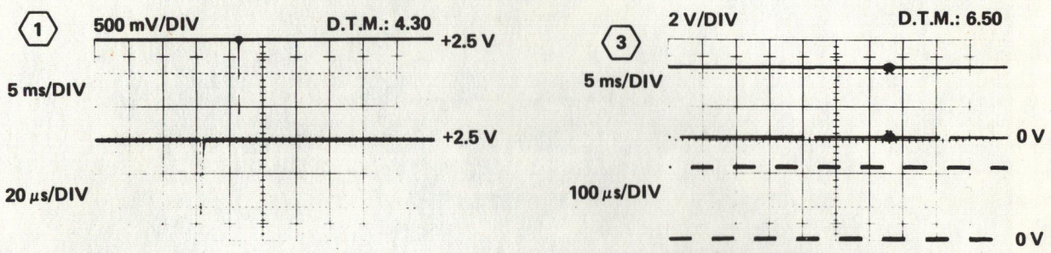
WAVEFORMS

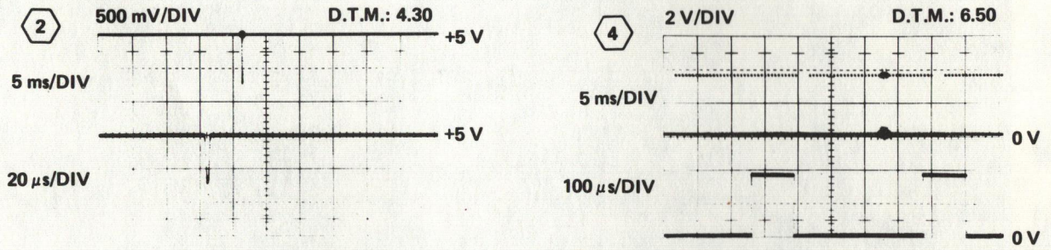
COMP SYNC AMPLIFIER

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. U301: PIN 10 IS GROUNDED PIN 5 IS VCC, +5V
3. ALL OTHER IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V

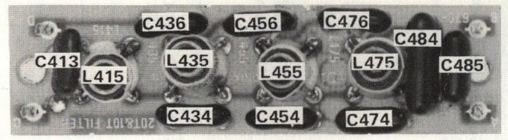
+15V
C18 22µF
R7 3.01K
CR7
LOW FOR NON SYNC
Q394 9a
C29 53
COMP SYNC FILTER ADJ.
L120 2-6µH
TP35
R40 7.50K
R42 2.00K
Q141
Q151
R44 121
CR48
C46 87
C28 220
L20
C32 518
R20 22
P5970-3 5a
STRIPPED SYNC
U101A 7402
CR8
Q21
P201
R3 1.0K
R5 402K
R382 1.1K
+5V
-15V
R164 10K
R199 7.15K
R142 2K
R62 1K
R68 56K
C55 .02
Q61
C160 5.6µF
R162 10K
Q71
R166 10
R61 75
C60 15µF
P70
P9852 11
P9832 11
P9802 11
P20
J9002
COMPOSITE SYNC
K370
R298 75
R284 4.7K
Q271
C290 22µF
C201 0.1
P298
P9014-22 2
CR390
R384 10K
Q381
CR372
C299 1µF
R368 150K
SUBCARRIER AMPLITUDE
R74 47
C198 .022
L190 12-43µH
C196 95
C194 95
R96 47
R174 2.74K
R176 2.74K
R172 7.50K
Q181
R260 390
C130 22µF
C76 .022
R78 1.8K
Q171
R178 4.02K
R168 11.0K
SUBCARRIER AMPLIFIER
P482
ON +5V
AUTO OFF
FULL FIELD BURST LOSS
R294 100
R296 300
A377 1K
R399 100
Q398
R379 1K
R480 3.9K
CW SUBCARRIER
J9004
P5970-1 5c
P398
P8100-1 8
P5600-2 5a
CW SUBCARRIER P5600-5 5c
P5600-1 5b
P70
C84 .02
R94 1K
R70 17.4K
Q81
Q91
R72 1K
VERT SYNC
2
U101D 7402
R234 1.2K
Q331
R236 470
BURST KEY
R409 1K
R408 10K
Q408
CR7 9a
5
P1001-8 1b
9 LINE KEY OUT
TIME 14 P2330-5 2a
TIME 30 P2630-3 2a
U321A 7400
U101C 7402
U201 7492
R265 4.3K
Q321
EQUALIZER WIDTH
SERRATION WIDTH
R251 1K
SYNC WIDTH
R351 2.5K
R356 10K
CR332
R334 1.2K
R238 6.98K
R336 37.4K
R231 3.32K
R415 1K
R420 19.1K
R418 3K
Q406
Q421
C415 253
C417 22
C407 528
R407 100
R416 10K
R428 17.4K
Q428
P7691-9 7b
P1001-9 1b
R312 1K
U321C 7400
U321B 7400
U321D 7400
HORIZ SYNC
TIME 16 P2330-7 2a
TIME 32 P2630-5 2a
P301
3
REGEN SYNC TIMING
C337 1000
U301 74121
4
R329 100
NON SYNC INHIBIT
LOW FOR NON SYNC
R386 4.7K
R387 100
Q394
R362 10K
R366 2.2K
U101B 7402
CR268
R364 27
C379 15µF
Q391
C278 .001
R267 75K
Q351
-15V
P/O A9 SUBCARRIER & SYNC OUT BOARD
P4590-7 4
P398
P5970-5 5b
DS9202 2
P8600-1 8
P401
P7003-2 7b
P8800-3 8
P201

9 b





Voltages and Waveforms obtained under conditions given on back side of Section 8 Title page.



A14 FILTER BOARD

SIN^2 PULSE GEN & MODE SEQUENCE

9 b

SIN^2 PULSE GENERATOR

C487
C494

CR477
CR485
CR498
CR499

Q466
Q498
Q499

R429
R462
R464
R482
R486

R488
R495
R496
R498
R499

TP428

FILTER BOARD

C413
C434
C436
C454
C456

C474
C476
C484
C485

L415
L435
L455
L475

FLAT FIELD LOGIC

C458

Q411
Q499

R440
R458
R471

TP460

U450A
U470A
U470B

ALTERNATE SWITCHING LOGIC

C438

CR452
CR454
CR456

P430

R338
R358
R434
R455
R473

TP490

U430A
U430B
U339A
U339B
U450B

U450D
U359A
U359B
U359C
U359D

MOD PULSE ENABLE

U450C

WAVEFORMS

SIN² PULSE GENERATOR

A14 FILTER BOARD

ALTERNATE SWITCHING LOGIC

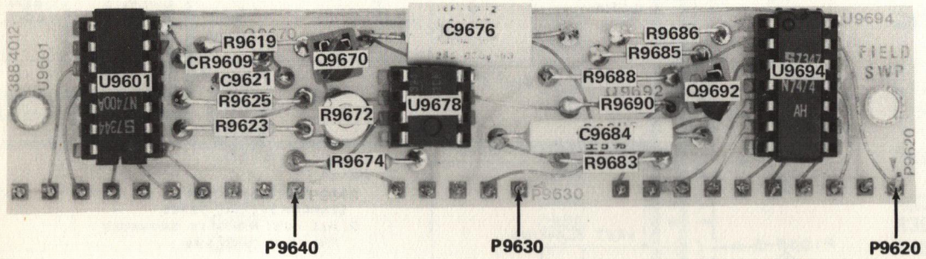
FLAT FIELD LOGIC

MOD PULSE ENABLE

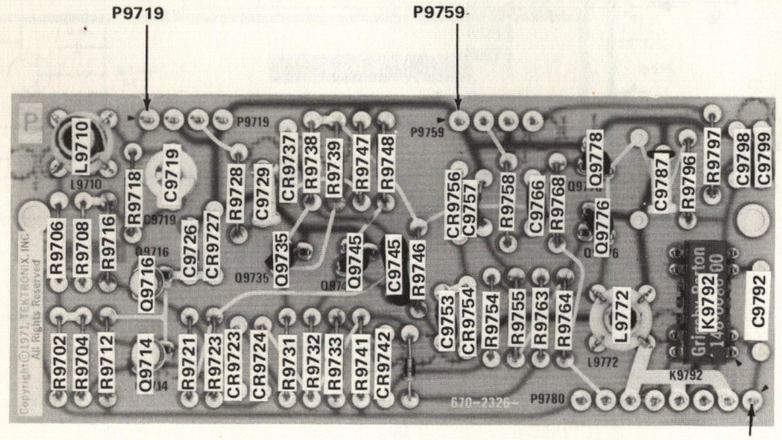
P/O A9 SUBCARRIER & SYNC OUT BOARD

NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES
2. ALL IC'S: PIN 7 IS GROUNDED PIN 14 IS VCC, +5V

P499
P2090-2 ◇2 a
P4930-4 ◇4
P9640-5 ◇10
MOD P&B BAR TIMING
MOD P&B
CR499
CR498
Q499
+5V
R462 2.2k
SIN² BAR GAIN
R499 6.81k
R482 20K
CR477
-15V
R497 3.3k
+15V
R498 33K
C487 253
R469 180
P498
MOD PULSE TIMING
P2800-3 ◇2 b
R496 3.3K
Q498
R488 15K
+15V
CR485
C494 220
R486 10K
SIN² PULSE GAIN
Q466
A
B
C
D
L475 150-240
L455 45-130
L435 45-130
L415 45-130
C485 510 (SEL)
C474 304
C484 1200
C454 330
C476 360
C434 130
C456 253
C436 375
C413 62
TP428
R429 455
(SEL FOR PULSE WIDTH)
P431
P8960-2 ◇8
P7193-1 ◇7 b
P401
P4960-6 ◇4
MODIFIED VERT. BLANKING
P1003-3 ◇1 b
VERT. BLANKING
U339A 7474
TIME 31 P2630-4 ◇2 a
TIME 1 P2630-6 ◇2 a
U339B 7474
U430A 7474
U430B 7474
P430
ALT & 6 APL
FULL FLD & 3 APL
U450B 7400
U450D 7400
TP490
◇4
U359D 7400
U359C 7400
U359B 7400
FULL FLD SIG & 3 LINES FLAT FIELD ◇12
LOW FOR FF&3
R358 18K
+5V
+5V
R473 1K
CR456
CR452
CR454
LOW FOR P&B
C438 100 (SEL)
R434 10K
-15V
FULL FIELD ENABLE
P461
59260
PULSE BAR ◇12
P4590-1 ◇4
P498
P4960-3 ◇4
59280
ALL LINES ◇12
P301
LOW FOR ALL LINES
R338 18K
U359A 7400
+5V
R455 390
C458 100
R458 3.3K
Q449
U470A 7451
TP460
◇3
U450A 7400
U470B 7451
HIGH FOR ALL LINES
ALT
LOW FOR ALL LINES
P461
P4960-8 ◇4
P4960-9 ◇4
P498
P3930-1 ◇3 b
P401
P3801-1 ◇3 b
59260
FLAT FIELD ◇12
LOW FOR FLAT FIELD
8 FLAT FIELD ENABLE
59275
VAR APL ◇2
LOW FOR PRESET & VAR. APL
P2690-7 ◇2 b
CCIR-1 SIG-III PULSE MOD
U450C 7400
Q411
R471 18K
LOW FOR FIELD SQ WAVE
R440 10K
P498
P2800-1 ◇2 b



A10 FIELD SWEEP BOARD



A11 EXT DRIVE RECEIVER BOARD

FIELD SWEEP & EXT DRIVE

10

FIELD SWEEP BOARD

C9621
C9676
C9684

CR9609

Q9670
Q9692

R9619
R9623
R9625
R9672
R9674

R9682
R9683
R9685
R9686
R9688
R9690

U9610A
U9610A
U9610B
U9610C
U9601D
U9671D

U9694A
U9694B

EXTERNAL DRIVE RECEIVER BOARD

C9719
C9726
C9729
C9745
C9753

C9757
C9766
C9787
C9792
C9798
C9799

CR9723
CR9724
CR9727
CR9737
CR9742

CR9743
CR9754
CR9756

K9792

L9710
L9772

Q9714
Q9716
Q9735
Q9745
Q9776
Q9778

R9702
R9704
R9706
R9708
R9712
R9716
R9718
R9721
R9723
R9728

R9731
R9732
R9733
R9738
R9739

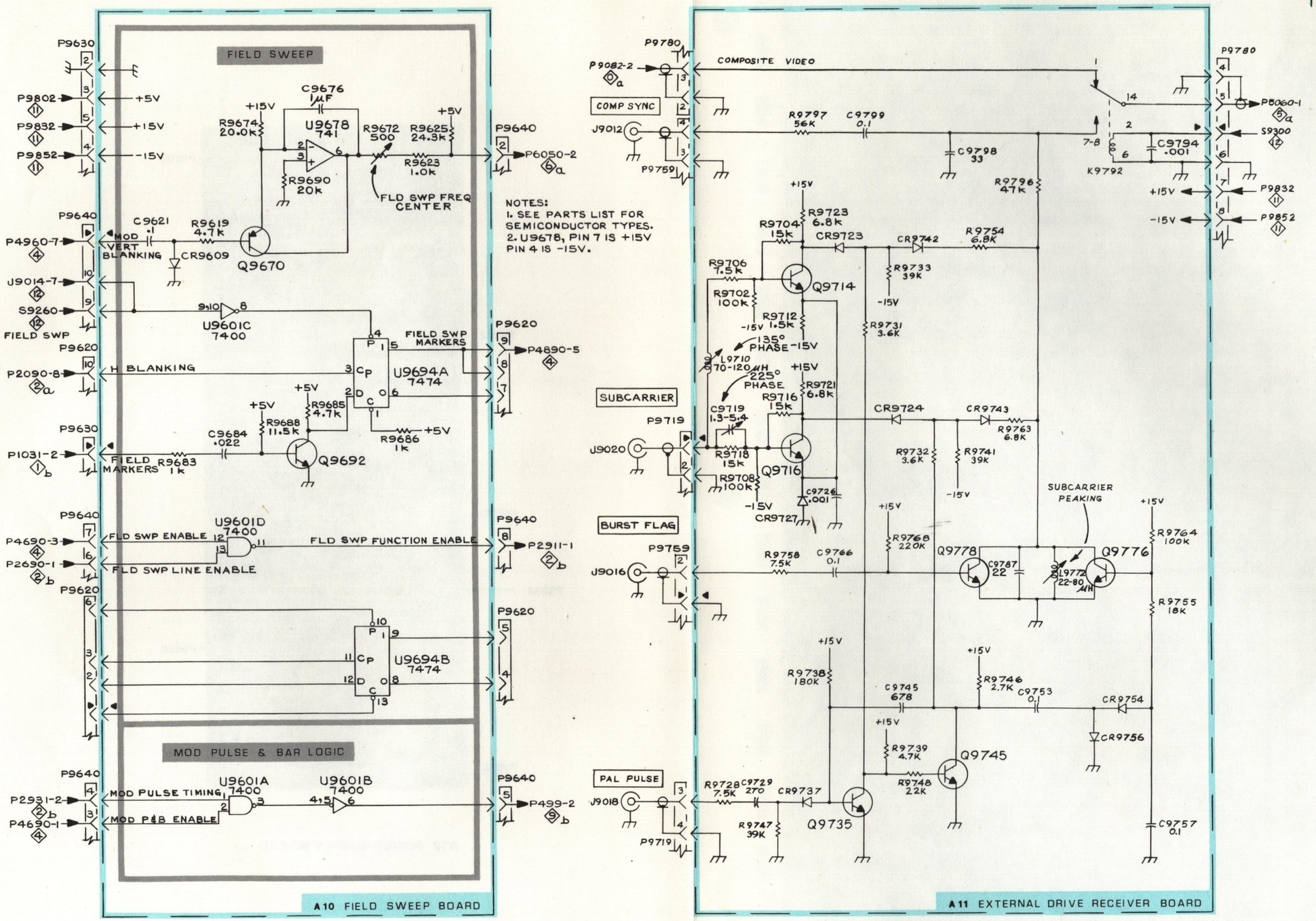
R9741
R9746
R9747
R9748
R9754

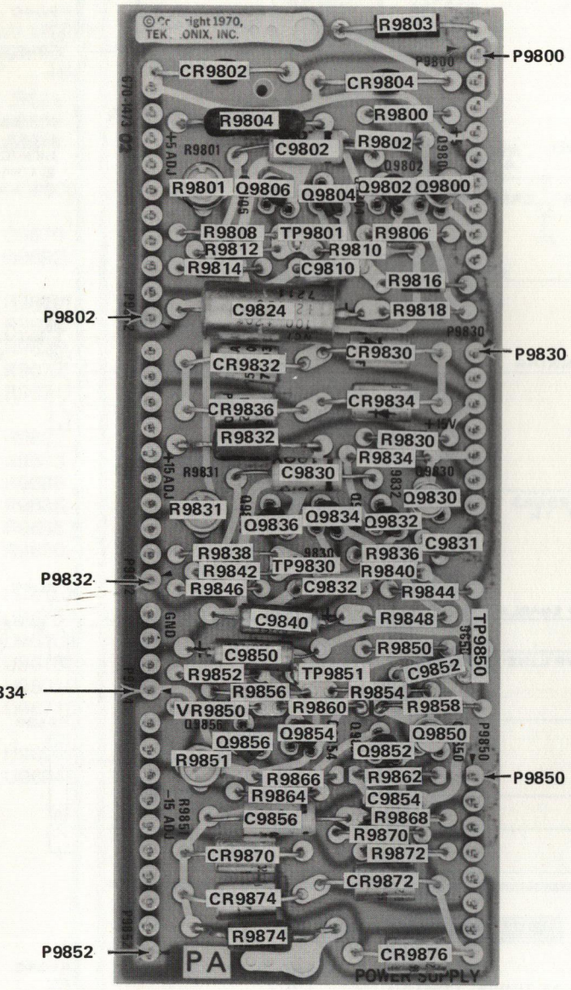
R9755
R9758
R9763
R9764
R9768

R9796
R9797

OFF BOARD COMPONENTS

J9012
J9016
J9018
J9020


FIELD SWEEP
P9630
P9802
+5V
P9832
+15V
P9852
-15V
C9676
1µF
+15V
R9674
20.0k
U9678
741
R9672
500
R9625
24.3k
+5V
P9640
P6050-2
R9623
1.0k
R9690
20k
FLD SWP FREQ CENTER
P9640
P4960-7
C9621
.1
R9619
4.7k
MOD VERT BLANKING
CR9609
Q9670
J9014-7
S9260
FIELD SWP
U9601C
7400
P9620
P2090-8
H BLANKING
U9694A
7474
FIELD SWP MARKERS
P9620
P4890-5
P9630
P1031-2
FIELD MARKERS
R9683
1k
C9684
.022
R9685
4.7k
R9688
11.5k
Q9692
R9686
1k
P9640
P4690-3
P2690-1
FLD SWP ENABLE
FLD SWP LINE ENABLE
U9601D
7400
FLD SWP FUNCTION ENABLE
P9640
P2911-1
P9620
U9694B
7474
MOD PULSE & BAR LOGIC
P9640
P2931-2
P4690-1
MOD PULSE TIMING
MOD P&B ENABLE
U9601A
7400
U9601B
7400
P9640
P499-2
A10 FIELD SWEEP BOARD
NOTES:
1. SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
2. U9678, PIN 7 IS +15V PIN 4 IS -15V.
P9780
P9082-2
COMP SYNC
J9012
P9759
COMPOSITE VIDEO
R9797
56K
C9799
0.1
C9798
33
K9792
C9794
.001
P9780
P5060-1
S9300
P9832
P9852
R9796
4.7K
R9723
6.8k
R9704
15k
CR9723
CR9742
R9754
6.8K
R9706
7.5k
R9702
100k
Q9714
R9733
39K
R9731
3.6K
R9712
1.5k
135° PHASE
L9710
470-120µH
225° PHASE
SUBCARRIER
P9719
J9020
C9719
1.3-5.4
R9716
15k
R9721
6.8k
CR9724
CR9743
R9763
6.8K
R9718
15k
Q9716
R9708
100k
C9726
.001
CR9727
R9732
3.6K
R9741
39K
SUBCARRIER PEAKING
BURST FLAG
P9759
J9016
R9758
7.5K
C9766
0.1
R9768
220K
Q9778
C9787
22
L9772
22-80µH
Q9776
R9764
100K
R9755
18K
R9738
180K
C9745
678
R9746
2.7K
C9753
0.1
CR9754
CR9756
R9739
4.7K
Q9745
PAL PULSE
J9018
P9719
R9728
7.5K
C9729
270
CR9737
R9747
39K
Q9735
R9748
2.2K
C9757
0.1
A11 EXTERNAL DRIVE RECEIVER BOARD



A12 POWER SUPPLY BOARD

POWER SUPPLY

11

+15 VOLT SUPPLY

C9011
C9803
C9831
C9832
C9840

CR9830
CR9832
CR9834
CR9836

Q9035
Q9830
Q9832
Q9834
Q9836

R9830
R9831
R9832
R9834
R9836

R9838
R9840
R9842
R9844
R9846
R9848

TP9830

+5 VOLT SUPPLY

C9042
C9044
C9802
C9810
C9824

CR9802
CR9804

Q9055
Q9800
Q9802
Q9804
Q9806

R9800
R9801
R9802
R9803
R9804

R9806
R9808
R9810
R9812
R9814

R9816
R9818

TP9801

Q9085
Q9850
Q9852
Q9854
Q9856

R9850
R9851
R9852
R9854
R9856

R9858
R9860
R9862
R9864
R9866

R9868
R9870
R9872
R9874

TP9850
TP9851

VR9850

OFF BOARD COMPONENTS

F9201
F9202

FL9201

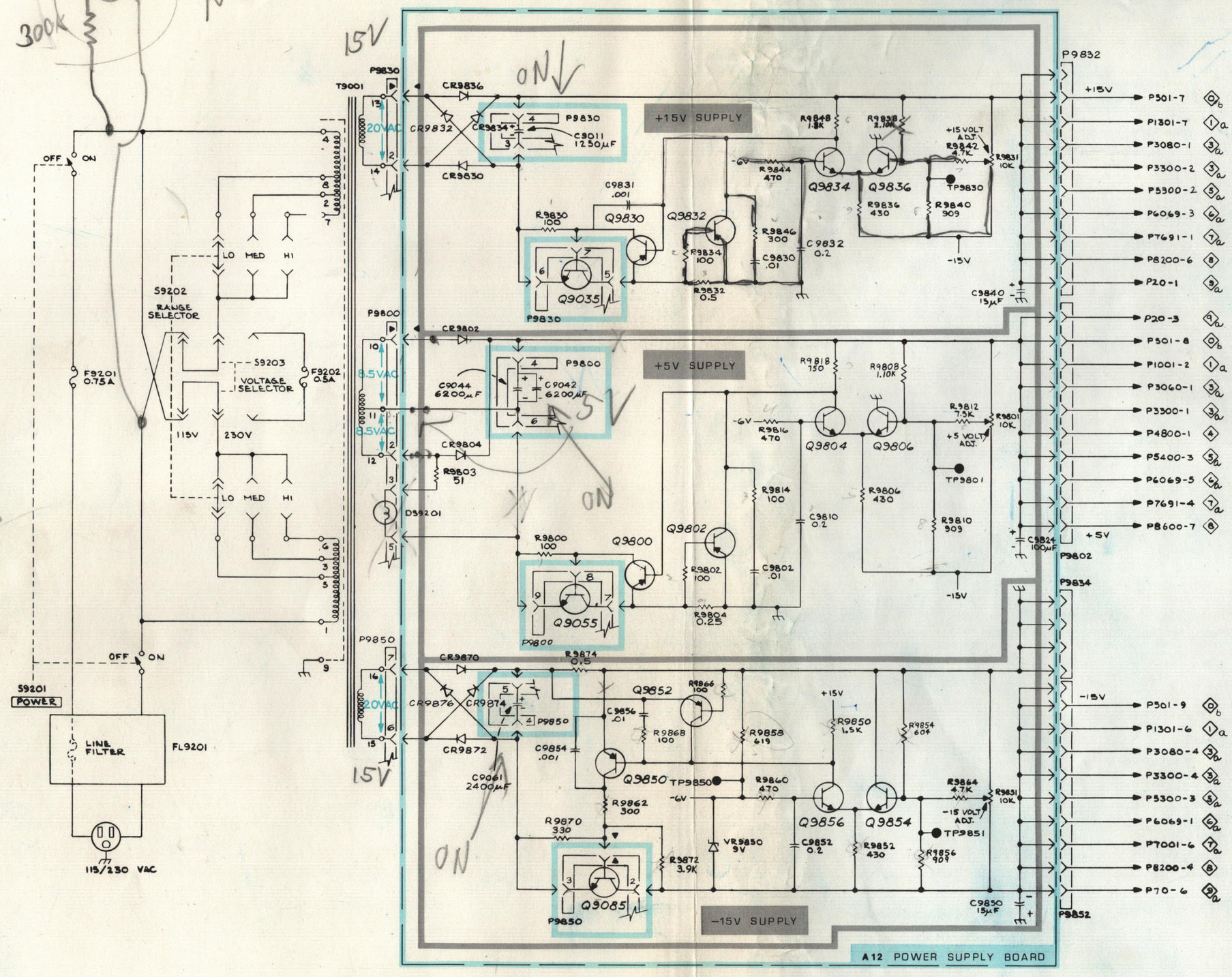
S9201
S9202
S9203

T9001

–15 VOLT SUPPLY

C9061
C9850
C9852
C9854
C9856

CR9870
CR9872
CR9874
CR9876


300K
Neon
15V
ON
P9830
T9001
CR9836
CR9832
CR9834
P9830
C9011
1250µF
CR9830
20VAC
+15V SUPPLY
R9848
1.8K
R9838
2.16K
+15 VOLT
ADJ.
R9842
4.7K
R9831
10K
R9844
470
Q9834
Q9836
TP9830
R9836
430
R9840
909
-15V
C9831
.001
Q9830
Q9832
R9830
100
R9846
300
C9832
0.2
R9834
100
C9830
.01
R9832
0.5
Q9035
P9830
C9840
15µF
P9832
+15V
P501-7
P1301-7
P3080-1
P3300-2
P5300-2
P6069-3
P7691-1
P8200-6
P20-1
P20-3
P501-8
P1001-2
P3060-1
P3300-1
P4800-1
P5400-3
P6069-5
P7691-4
P8600-7
+5V
P9802
P9834
P9800
CR9802
8.5VAC
8.5VAC
C9044
6200µF
C9042
6200µF
P9800
+5V SUPPLY
R9818
750
R9808
1.10K
R9812
7.5K
R9801
10K
-6V
R9816
470
Q9804
Q9806
+5 VOLT
ADJ.
TP9801
CR9804
R9803
51
D9201
R9814
100
C9810
0.2
R9806
430
R9810
909
Q9802
R9800
100
Q9800
R9802
100
C9802
.01
Q9055
P9800
R9804
0.25
-15V
P9850
CR9870
R9874
0.5
Q9852
R9866
100
+15V
CR9876
CR9874
P9850
C9856
.01
R9868
100
R9858
619
R9850
1.5K
R9854
604
CR9872
C9854
.001
C9061
2400µF
Q9850
TP9850
R9860
470
R9864
4.7K
R9851
10K
-15V
P501-9
P1301-6
P3080-4
P3300-4
P5300-3
P6069-1
P7001-6
P8200-4
P70-6
R9862
300
-6V
Q9856
Q9854
-15 VOLT
ADJ.
TP9851
R9870
330
VR9850
9V
C9852
0.2
R9852
430
R9856
909
R9872
3.9K
Q9085
P9850
C9850
15µF
P9852
-15V SUPPLY
A12 POWER SUPPLY BOARD
S9202
RANGE
SELECTOR
S9203
VOLTAGE
SELECTOR
LO MED HI
115V
230V
F9201
0.75A
F9202
0.5A
OFF ON
S9201
POWER
LINE
FILTER
FL9201
115/230 VAC
15V
ON
ON
ON

SWITCHING

12

SYNC

DS9202

S9300

POWER

DS9201

S9201

LINEARITY

S9253
S9255

INSERTION SIGNAL CONTROL

C9209
C9215

DS9210
DS9211
DS9212

J9210

R9205
R9209
R9210
R9212
R9215

S9205
S9212
S9213
S9250

NOISE & PEDESTAL

R9223
R9225
R9230
R9231
R9232

R9233
R9234
R9235
R9236
R9237

R9238
R9239

S9225
S9230
S9235
S9240

FULL FIELD SIG

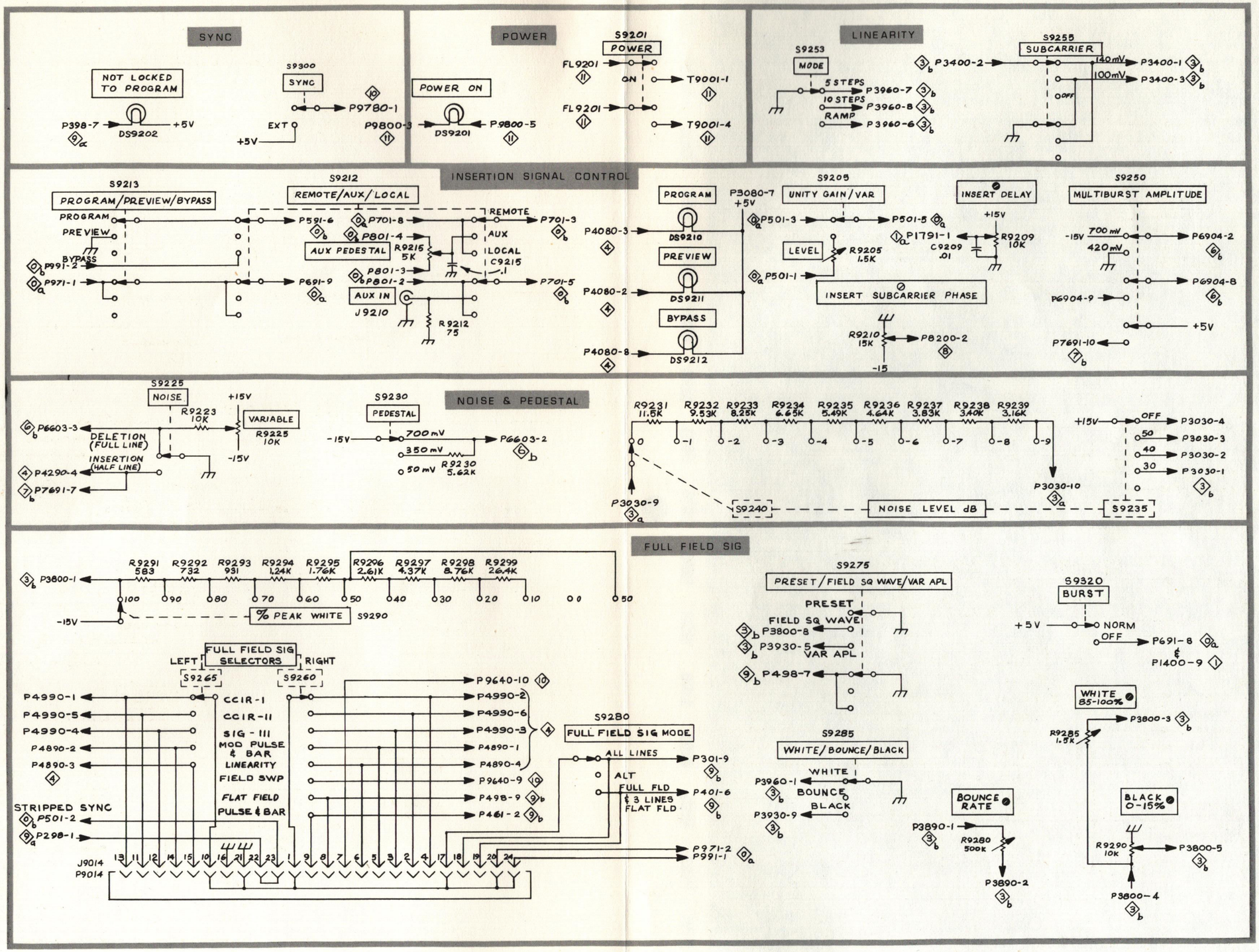
R9280
R9285
R9290
R9291
R9292

R9293
R9294
R9295
R9296
R9297

R9298
R9299

S9260
S9265
S9275
S9280
S9285

S9290
S9320


SYNC
NOT LOCKED TO PROGRAM
P398-7
DS9202
+5V
S9300
SYNC
EXT
+5V
P9780-1
P9800-3
POWER
POWER ON
DS9201
P9800-5
S9201
POWER
FL9201
ON
T9001-1
FL9201
T9001-4
LINEARITY
S9253
MODE
5 STEPS
P3960-7
10 STEPS
P3960-8
RAMP
P3960-6
S9255
SUBCARRIER
P3400-2
140mV
P3400-1
100mV
P3400-3
OFF
INSERTION SIGNAL CONTROL
S9213
PROGRAM/PREVIEW/BYPASS
PROGRAM
PREVIEW
BYPASS
P991-2
P971-1
P691-9
S9212
REMOTE/AUX/LOCAL
REMOTE
AUX
LOCAL
C9215
.1
P591-6
P701-8
P701-3
AUX PEDESTAL
R9215
5K
P801-4
P801-3
P801-2
P701-5
AUX IN
J9210
R9212
75
PROGRAM
PREVIEW
BYPASS
DS9210
DS9211
DS9212
P4080-3
P4080-2
P4080-8
P3080-7
+5V
S9205
UNITY GAIN/VAR
P501-3
P501-5
LEVEL
R9205
1.5K
P501-1
P1791-1
INSERT DELAY
+15V
R9209
10K
C9209
.01
INSERT SUBCARRIER PHASE
R9210
15K
P8200-2
-15
S9250
MULTIBURST AMPLITUDE
-15V
700 mV
420 mV
P6904-2
P6904-8
P6904-9
+5V
P7691-10
NOISE & PEDESTAL
S9225
NOISE
+15V
R9223
10K
VARIABLE
R9225
10K
-15V
P6603-3
DELETION (FULL LINE)
INSERTION (HALF LINE)
P4290-4
P7691-7
S9230
PEDESTAL
-15V
700 mV
350 mV
50 mV
R9230
5.62K
P6603-2
R9231 11.5K
R9232 9.53K
R9233 8.25K
R9234 6.65K
R9235 5.49K
R9236 4.64K
R9237 3.83K
R9238 3.40K
R9239 3.16K
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
P3030-9
P3030-10
S9240
NOISE LEVEL dB
S9235
+15V
OFF
50
40
30
P3030-4
P3030-3
P3030-2
P3030-1
FULL FIELD SIG
R9291 583
R9292 732
R9293 931
R9294 1.24K
R9295 1.76K
R9296 2.61K
R9297 4.37K
R9298 8.76K
R9299 26.4K
P3800-1
100
90
80
70
60
50
40
30
20
10
0
50
-15V
% PEAK WHITE
S9290
FULL FIELD SIG SELECTORS
LEFT
RIGHT
S9265
S9260
P4990-1
P4990-5
P4990-4
P4890-2
P4890-3
CCIR-1
CCIR-II
SIG - III
MOD PULSE & BAR
LINEARITY
FIELD SWP
FLAT FIELD
PULSE & BAR
STRIPPED SYNC
P501-2
P298-1
J9014
P9014
P9640-10
P4990-2
P4990-6
P4990-3
P4890-1
P4890-4
P9640-9
P498-9
P461-2
S9280
FULL FIELD SIG MODE
ALL LINES
ALT
FULL FLD & 3 LINES FLAT FLD
P301-9
P401-6
P971-2
P991-1
S9275
PRESET/FIELD SQ WAVE/VAR APL
PRESET
FIELD SQ WAVE
P3800-8
P3930-5
VAR APL
P498-7
S9285
WHITE/BOUNCE/BLACK
WHITE
P3960-1
BOUNCE
BLACK
P3930-9
BOUNCE RATE
P3890-1
R9280
500K
P3890-2
S9320
BURST
+5V
NORM
OFF
P691-8
&
P1400-9
WHITE 85-100%
P3800-3
R9285
1.5K
BLACK 0-15%
R9290
10K
P3800-5
P3800-4

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
\- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
\- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
\- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
0000C	GETTIG ENGINEERING AND MANUFACTURING CO.		SPRINGMILL, PA 16875
00779	AMP, INC.	P. O. BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P. O. BOX 5012	DALLAS, TX 75222
06666	GENERAL DEVICES CO., INC.	525 S. WEBSTER AVE.	INDIANAPOLIS, IN 46219
06982	MOORE, HOWARD J., CO.	105 E. 16TH ST.	NEW YORK, NY 10003
09353	C AND K COMPONENTS, INC.	103 MORSE STREET	WATERTOWN, MA 02172
09422	PLASTIC STAMPING CORP.	2216 W. ARMITAGE AVE.	CHICAGO, IL 60647
12136	PHILADELPHIA HANDLE CO., INC.	1643 HADDON AVE.	CAMDEN, NJ 08103
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
46384	PENN ENGINEERING AND MFG. CORP.	OLD EASTON HIGHWAY	DOYLESTOWN, PA 18901
70276	ALLEN MFG. CO.	P. O. DRAWER 570	HARTFORD, CT 06101
71785	TRW ELECTRONIC COMPONENTS, CINCH CONNECTOR OPERATIONS	1501 MORSE AVE.	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
80033	PRESTOLE EVERLOCK, INC.	P. O. BOX 278-1345 MIAMI ST.	TOLEDO, OH 43605
82647	TEXAS INSTRUMENTS, INC., CONTROL PRODUCTS DIV.	34 FOREST ST.	ATTLEBORO, MA 02703
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
91737	ITT GREMAR, INC.	922 S. LYON ST.	SANTA ANA, CA 92705
94222	SOUTHCO, INC.		LESTER, PA 19113
95712	BENDIX CORP., THE ELECTRICAL COMPONENTS DIV., MICROWAVE DEVICES PLANT	HURRICANE ROAD	FRANKLIN, IN 46131

FIGURE 1 FRONT & CABINET

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	366-0500-00			5	KNOB:GRAY,4 SIDED	80009	366-0500-00
	----- -----			-	. EACH KNOB INCLUDES:		
	213-0153-00			2	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-2	366-1189-00			2	KNOB:GRAY	80009	366-1189-00
	----- -----			-	. EACH KNOB INCLUDES:		
	213-0153-00			1	. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-3	366-0215-02			13	KNOB:LEVER SWITCH	80009	366-0215-02
-4	367-0102-00			2	HANDLE,BOW:	80009	367-0102-00
					(ATTACHING PARTS FOR EACH)		
-5	212-0004-00			2	SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-6	213-0216-00			2	THUMBSCREW:10-32 X 0.75 INCH LONG SST	80009	213-0216-00
					(ATTACHING PARTS FOR EACH)		
-7	354-0025-00			1	RING,RETAINING:0.181 INCH FREE ID	79136	5555-18
-8	210-0894-00			1	WASHER,NONMETAL:0.19 ID X 0.438"OD,PLSTC	09422	OBD
					- - - * - - -		
-9	124-0270-00			1	STRIP,TRIM:RIGHT	80009	124-0270-00
-10	124-0270-01			1	STRIP,TRIM:LEFT	80009	124-0270-01
-11	407-0510-00			2	BRACKET,ANGLE:	80009	407-0510-00
					(ATTACHING PARTS FOR EACH)		
-12	212-0004-00			2	SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-13	351-0104-00			PR	SLIDE SECT.,DWR:PAIR	80009	351-0104-00
					(ATTACHING PARTS)		
-14	212-0004-00			4	SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-15	390-0309-00			1	COVER,CAL FXTR:TOP	80009	390-0309-00
-16	355-0134-00			2	. STUD,TURNLOCK F:FLAT HEAD STEEL	94222	82-14-140-16
-17	355-0135-01			12	. STUD TURNLOCK F:OVH STEEL,FOR0.14" THK PNL	94222	82-11-140-16
-18	214-0389-00			14	. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
-19	200-1394-02			1	DOOR,ACCESS:MARKED	80009	200-1394-02
					(ATTACHING PARTS)		
-20	210-0586-00			3	NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
	----- -----			-	. DOOR INCLUDES:		
-21	355-0135-01			1	. STUD TURNLOCK F:OVH STEEL,FOR0.14" THK PNL	94222	82-11-140-16
-22	214-0389-00			1	. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
-23	390-0063-00			1	COVER,CAL FXTR:BOTTOM	80009	390-0063-00
-24	355-0134-00			2	. STUD,TURNLOCK F:FLAT HEAD STEEL	94222	82-14-140-16
-25	355-0135-01			12	. STUD TURNLOCK F:OVH STEEL,FOR0.14" THK PNL	94222	82-11-140-16
-26	214-0389-00			14	. FSTNR,RETAINER:SPLIT RING	94222	82-32-101-17
-27	260-0834-00			1	SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD	09353	7201-SN
					(ATTACHING PARTS)		
-28	210-0562-00			2	NUT,PLAIN,HEX.:0.25-40 X 0.312 INCH,BBS	73743	2X20224-402
-29	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
					- - - * - - -		
-30	----- -----			1	RESISTOR,VARIABLE:(SEE R9215 EPL)		
					(ATTACHING PARTS)		
-31	210-0590-00			2	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-32	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-33	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
					- - - * - - -		
-34	----- -----			1	RES.,VARIABLE:(SEE R9225 EPL)		
					(ATTACHING PARTS)		
-35	210-0590-00			1	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-36	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-37	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
					- - - * - - -		
-38	260-1252-00			1	SWITCH,ROTARY:	80009	260-1252-00
					(ATTACHING PARTS)		
-39	210-0590-00			1	NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-40	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
					- - - * - - -		

FIGURE 1 FRONT & CABINET (cont)

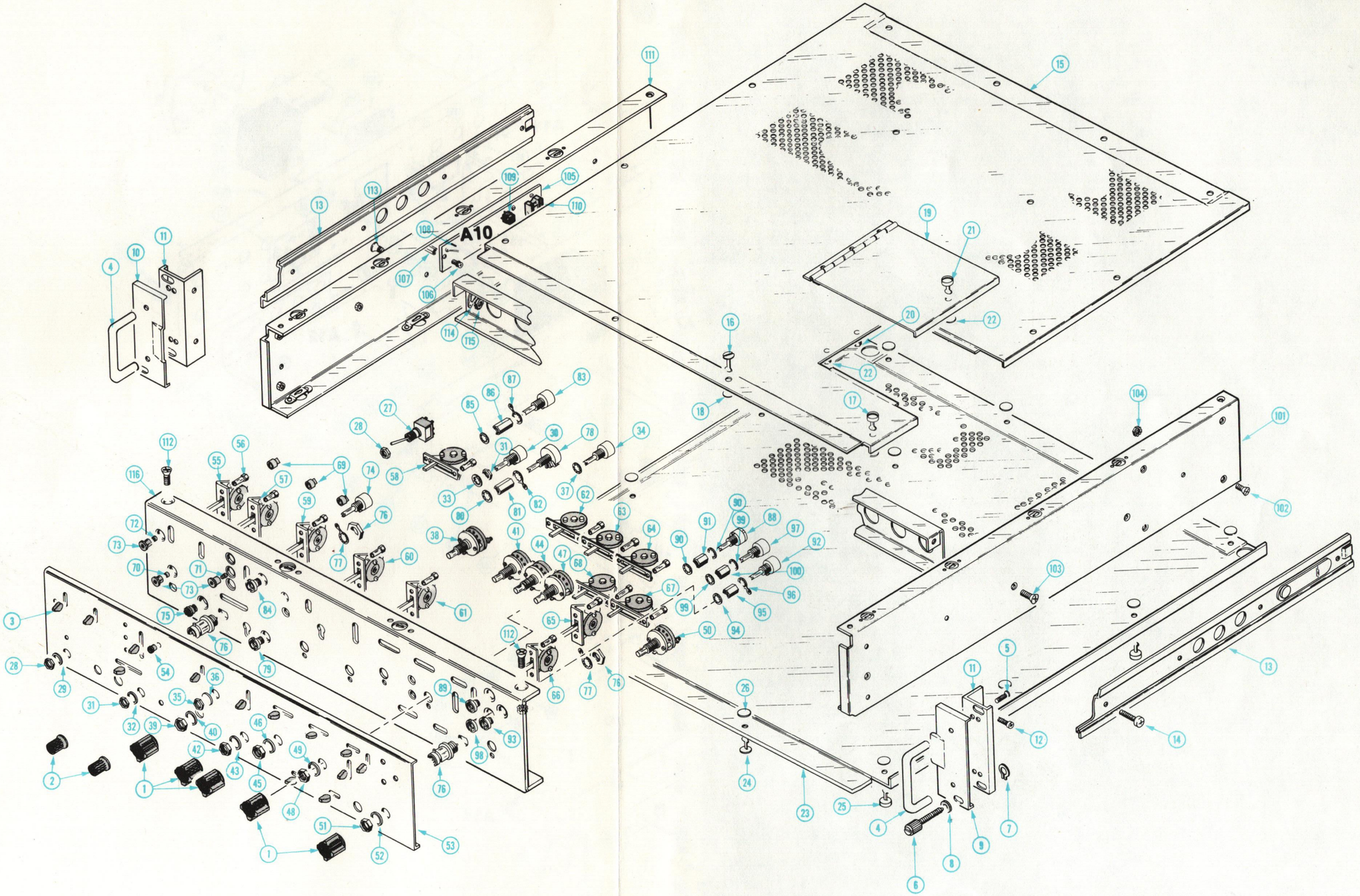
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-41	260-1251-00			1		SWITCH,ROTARY:	80009	260-1251-00
						(ATTACHING PARTS)		
-42	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-43	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - -- -		
-44	260-1388-00			1		SWITCH,ROTARY:	80009	260-1388-00
						(ATTACHING PARTS)		
-45	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-46	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-47	260-1250-00			1		SWITCH,ROTARY:	80009	260-1250-00
						(ATTACHING PARTS)		
-48	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-49	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-50	260-1374-00			1		SWITCH,ROTARY:	80009	260-1374-00
						(ATTACHING PARTS)		
-51	210-0590-00			1		NUT,PLAIN,HEX.:0.375 X 0.438 INCH,STL	73743	2X28269-402
-52	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-53	333-1946-00			1		PANEL,FRONT:	80009	333-1946-00
-54	358-0301-00			5		BUSHING,SLEEVE:FOR 0.185 DIA HOLE,GRAY	80009	358-0301-00
-55	260-0731-00			1		SWITCH,LEVER:	80009	260-0731-00
						(ATTACHING PARTS)		
-56	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-57	260-0731-00			1		SWITCH,LEVER:	80009	260-0731-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-58	260-1375-00			1		SWITCH,LEVER:	80009	260-1375-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-59	260-1390-00			1		SWITCH,LEVER:	80009	260-1390-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-60	260-0731-00			1		SWITCH,LEVER:	80009	260-0731-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-61	260-0621-00			1		SWITCH,LEVER:	80009	260-0621-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-62	260-1376-00			1		SWITCH,LEVER:	80009	260-1376-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-63	260-0621-00			1		SWITCH,LEVER:	80009	260-0621-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-64	260-1383-00			1		SWITCH,LEVER:	80009	260-1383-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		
-65	260-0621-00			1		SWITCH,LEVER:	80009	260-0621-00
						(ATTACHING PARTS)		
	220-0413-00			2		NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
						- - - * - - -		

FIGURE 1 FRONT & CABINET (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-66	260-1389-00			1	SWITCH,LEVER:	80009	260-1389-00
					(ATTACHING PARTS)		
	220-0413-00			2	NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
					- - - * - - -		
-67	260-0731-00			1	SWITCH,LEVER:	80009	260-0731-00
					(ATTACHING PARTS)		
	220-0413-00			2	NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
					- - - * - - -		
-68	260-0621-00			1	SWITCH,LEVER:	80009	260-0621-00
					(ATTACHING PARTS)		
	220-0413-00			2	NUT,SLEEVE:4-40 X 0.562 INCH LONG	80009	220-0413-00
					- - - * - - -		
-69	200-0935-00			5	BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
-70	378-0602-00			2	LENS,LIGHT:GREEN	80009	378-0602-00
-71	378-0602-01			1	LENS,LIGHT:AMBER	80009	378-0602-01
-72	378-0602-02			2	LENS,LIGHT:RED	80009	378-0602-02
-73	352-0157-01			5	LAMPHOLDER:BLACK PLASTIC	80009	352-0157-01
-74	----- -----			1	RES.,VARIABLE:(SEE R9205 EPL)		
					(ATTACHING PARTS)		
	213-0020-00			1	SETSCREW:6-32 X 0.125 INCH,HEX.SOC STL	70276	OBD
					- - - * - - -		
-75	366-0261-00			1	KNOB:0.312 OD X 0.406 INCH LONG	80009	366-0261-00
-76	131-0106-02			2	CONNECTOR,RCPT,:BNC	80009	131-0106-02
					(ATTACHING PARTS FOR EACH)		
-77	210-0255-00			1	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
					- - - * - - -		
-78	----- -----			1	RES.,VARIABLE:(SEE R9210 EPL)		
					(ATTACHING PARTS)		
-79	358-0409-00			1	BSHG,MACH.THD:0.25-32 X 0.159 ID X 0.24	80009	358-0409-00
-80	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-81	210-0471-00			1	NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG	80009	210-0471-00
-82	210-0255-00			1	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
					- - - * - - -		
-83	----- -----			1	RES.,VARIABLE:(SEE R9209 EPL)		
					(ATTACHING PARTS)		
-84	358-0409-00			1	BSHG,MACH.THD:0.25-32 X 0.159 ID X 0.24	80009	358-0409-00
-85	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-86	210-0471-00			1	NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG	80009	210-0471-00
-87	210-0255-00			1	TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
					- - - * - - -		
-88	----- -----			1	RES.,VARIABLE:(SEE R9285 EPL)		
					(ATTACHING PARTS)		
-89	358-0422-00			1	BSHG,MACH.THD:0.25-32 X 0.187" LONG BRS	80009	358-0422-00
-90	210-0046-00			2	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-91	220-0484-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL	80009	220-0484-00
					- - - * - - -		
-92	----- -----			1	RES.,VARIABLE:(SEE R9290 EPL)		
					(ATTACHING PARTS)		
-93	358-0422-00			1	BSHG,MACH.THD:0.25-32 X 0.187" LONG BRS	80009	358-0422-00
-94	210-0046-00			1	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-95	220-0484-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL	80009	220-0484-00
-96	210-0223-00			1	TERMINAL,LUG:0.25 INCH DIA,SE	78189	2101-14-03-2520N
					- - - * - - -		
-97	----- -----			1	RES.,VARIABLE:(SEE R9280 EPL)		
					(ATTACHING PARTS)		
-98	358-0422-00			1	BSHG,MACH.THD:0.25-32 X 0.187" LONG BRS	80009	358-0422-00
-99	210-0046-00			2	WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-100	220-0484-00			1	NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL	80009	220-0484-00
					- - - * - - -		
-101	390-0307-00			1	COVER,CAL FXTR:RIGHT	80009	390-0307-00
					(ATTACHING PARTS)		
-102	211-0538-00			10	SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
-103	211-0559-00			1	SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL	83385	OBD
-104	210-0457-00			11	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		

FIGURE 1 FRONT & CHASSIS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-105	----- -----			1	CKT BOARD ASSY:FIELD SWEEP(SEE A10 EPL)		
					(ATTACHING PARTS)		
-106	211-0116-00			2	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
-107	384-0617-00			2	POST,ELEC-MECH:HEX,0.25 X 0.375 INCH LONG	80009	384-0617-00
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-108	131-0589-00			25	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-109	136-0220-00			2	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-110	136-0269-02			2	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	136-0514-00			1	. SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
	390-0066-00			1	COVER,CAL FXTR:LEFT	80009	390-0066-00
					(ATTACHING PARTS)		
-112	211-0538-00			11	SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
-113	211-0559-00			1	SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL	83385	OBD
-114	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-115	210-0457-00			11	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-116	386-2194-00			1	SUBPANEL,FRONT:	80009	386-2194-00
					(ATTACHING PARTS)		
	211-0538-00			2	SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
	210-0457-00			2	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		



148-M

FIG. 2 CHASSIS

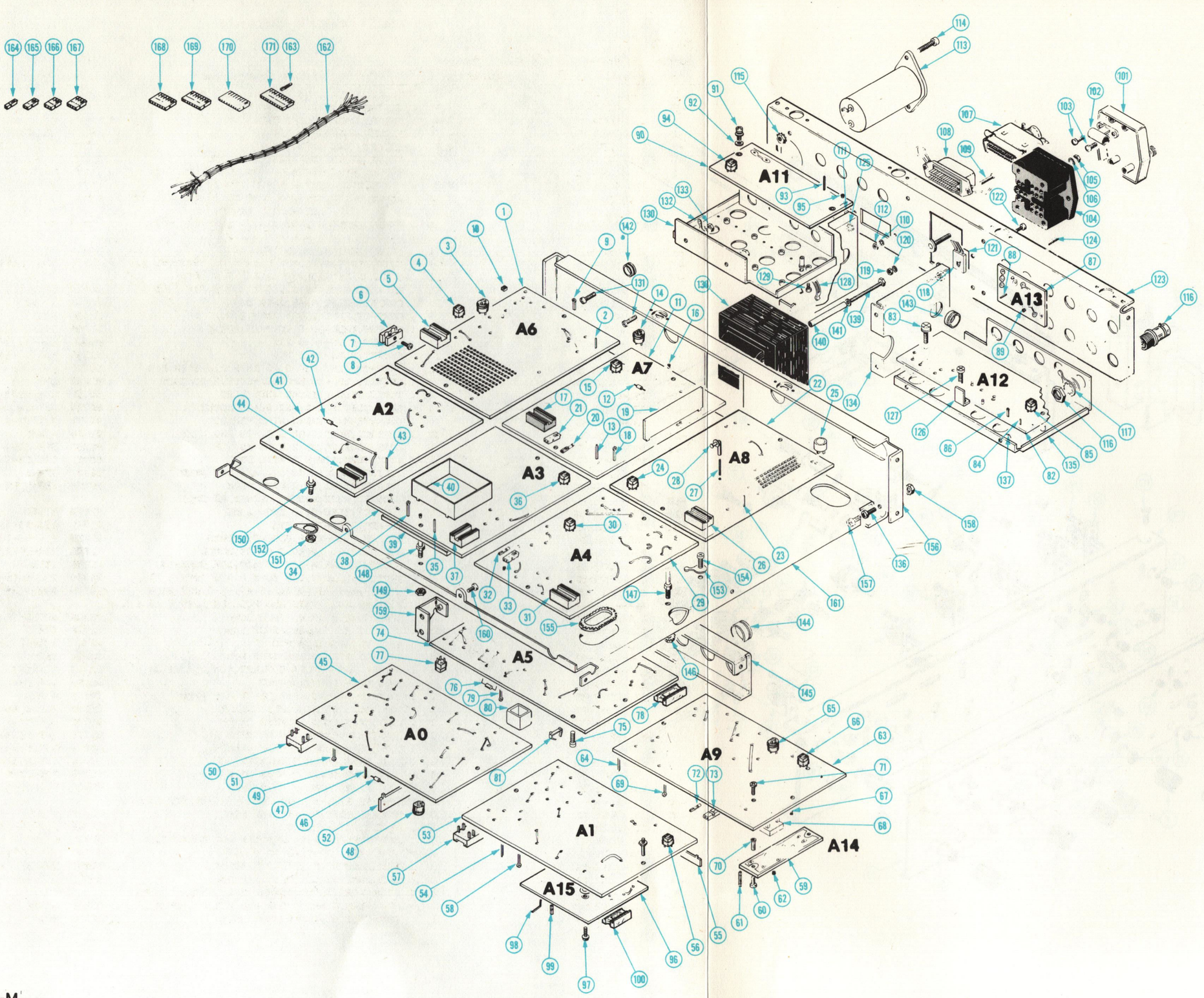


FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-1	----- -----			1	CKT BOARD ASSY:FUNCTION GEN(SEE A6 EPL)		
-2	131-0589-00			39	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			6	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-3	136-0183-00			4	. SOCKET,PLUG-IN:3 PIN	80009	136-0183-00
-4	136-0220-00			37	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
	136-0235-00			2	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-5	136-0269-02			1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-6	200-0945-00			1	. COVER,HALF XSTR:FOR DUAL TO-18 CASE	80009	200-0945-00
-7	200-0945-01			1	. COVER,HALF XSTR:FOR DUAL TO-18 CS,2-56 THD	80009	200-0945-01
					(ATTACHING PARTS)		
-8	211-0001-00			1	. SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-9	214-0579-00			1	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-10	344-0108-00			8	. CLIP,ELECTRICAL:FOR 0.045" OD SEMICOND DEVICE	80009	344-0108-00
-11	----- -----			1	CKT BOARD ASSY:OUTPUT AMP(SEE A7 EPL)		
-12	131-0566-00			1	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-13	131-0589-00			59	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			9	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
	136-0235-00			2	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-14	136-0183-00			2	. SOCKET,PLUG-IN:3 PIN	80009	136-0183-00
-15	136-0220-00			20	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-16	136-0352-00			32	. CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50872-2
-17	136-0514-00			1	. SOCKET,PLUG-IN:MICROCIRCUIT,8 CONTACT	82647	C930802
-18	214-0579-00			3	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-19	337-1456-00			3	. SHLD,ELECTRICAL:CKT BOARD MOUNT	80009	337-1456-00
	131-0993-07			1	. LINK,TERM.CONNE:2 WIRE VIOLET	00779	530153-7
-20	131-0707-00			2	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-21	352-0169-07			1	. CONN BODY,PL,EL:2 WIRE PURPLE	80009	352-0169-07
	131-0993-08			2	. LINK,TERM.CONNE:2 WIRE GRAY	00779	530153-8
	131-0707-00			4	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	352-0169-08			2	. CONN BODY,PL,EL:2 WIRE GRAY	80009	352-0169-08
-22	----- -----			1	CKT BOARD ASSY:MODULATOR(SEE A8 EPL)		
-23	131-0589-00			47	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-24	136-0220-00			18	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
	136-0235-00			2	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-25	136-0241-00			1	. SOCKET,PLUG-IN:10 CONTACT,ROUND	71785	133-99-12-064
-26	136-0269-02			4	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-27	214-0506-00			2	. CONTACT,ELEC:0.045 SQ X 0.375 INCH L	80009	214-0506-00
-28	352-0134-00			2	. HOLDER,COIL:TOROIDAL,0.472 X 0.417 INCH	80009	352-0134-00
-29	----- -----			1	CKT BOARD ASSY:VITS AND FULL FIELD(SEE A4 EPL)		
	131-0589-00			60	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			232	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-30	136-0220-00			3	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
	136-0252-04			24	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-31	136-0269-02			18	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	131-0993-00			9	. LINK,TERM.CONNE:JUMPER	00779	530153-2
-32	131-0707-00			2	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-33	352-0169-00			2	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	131-0993-01			3	. LINK,TERM.CONNE:2 WIRE BROWN	00779	530153-9
	131-0993-02			3	. LINK,TERM.CONNE:2 WIRE RED	00779	1-530153-0
	131-0993-03			3	. LINK,TERM.CONNE:2 WIRE ORANGE	00779	530153-4
	131-0993-04			3	. LINK,TERM.CONNE:2 WIRE YELLOW	00779	530153-4
	131-0993-05			4	. LINK,TERM.CONNE:2 WIRE GREEN	00779	530153-5
	131-0993-06			3	. LINK,TERM.CONNE:2 WIRE BLUE	00779	530153-6
-34	----- -----			1	CKT BOARD ASSY:APL STAIRCASE NOISE(SEE A3 EPL)		
-35	131-0608-00			70	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-36	136-0220-00			33	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-37	136-0269-02			8	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-38	214-0579-00			4	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-39	337-1512-00			1	. SHLD,ELECTRICAL:CIRCUIT BOARD	80009	337-1512-00
-40	337-1650-00			2	. SHLD,ELECTRICAL:CIRCUIT BOARD	80009	337-1650-00
-41	----- -----			1	CKT BOARD ASSY:HORIZONTAL TIMING(SEE A2 EPL)		
-42	131-0566-00			1	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-43	131-0608-00			446	. CONTACT,ELEC:0.365 INCH LONG	22526	47357

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-	136-0252-04			48	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-44	136-0269-02			20	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-45	----- -----			1	CKT BOARD ASSY:VIT INSERTION(SEE A0 EPL)		
-46	131-0566-00			1	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
-47	131-0589-00			66	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			6	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-48	136-0235-00			1	. SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-49	136-0252-04			96	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-50	136-0260-02			2	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
-51	214-0579-00			7	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-52	337-1456-00			1	. SHLD,ELECTRICAL:CKT BOARD MOUNT	80009	337-1456-00
-53	----- -----			1	CKT BOARD ASSY:VERTICAL COUNTER(SEE A1 EPL)		
-54	131-0589-00			48	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0592-00			12	. CONTACT,ELEC:0.885 INCH LONG	22526	47353
-55	131-0998-00			5	. BUSS BAR:9 TERM,8.132"LONG,CUT TO FIT	80009	131-0998-00
-56	136-0220-00			17	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-57	136-0269-02			18	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	220-0449-00			1	. NUT,SLEEVE:4-40 X 0.188 X 0.50" LONG	80009	220-0449-00
					(ATTACHING PARTS)		
	211-0116-00			1	. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					- - - * - - -		
-58	214-0579-00			14	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-59	----- -----			1	CKT BOARD ASSY:20 T FILTER(SEE A14 EPL)		
					(ATTACHING PARTS)		
-60	211-0007-00			2	SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-61	136-0263-03			4	. CONTACT,ELEC:FOR 0.025 INCH SQUARE PIN	00779	86250-2
-62	136-0352-00			16	. CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN	00779	50872-2
-63	----- -----			1	CKT BOARD ASSY:SUBCARRIER AND SYNC(SEE A9 EPL)		
-64	131-0589-00			77	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0590-00			4	. CONTACT,ELEC:0.71 INCH LONG	22526	47351
	131-0608-00			6	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-65	136-0183-00			1	. SOCKET,PLUG-IN:3 PIN	80009	136-0183-00
-66	136-0220-00			22	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-67	136-0252-04			17	. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-68	136-0269-02			8	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-69	214-0579-00			4	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-70	361-0094-00			2	. SPACER,STANDOFF:4-40 X 0.25",SELF CLINCHING	46384	S0A-440-8
					(ATTACHING PARTS)		
-71	211-0007-00			2	. SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
	131-0993-02			1	. LINK,TERM.CONNE:2 WIRE RED	00779	1-530153-0
-72	131-0707-00			2	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-73	352-0169-02			1	. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	131-0993-07			1	. LINK,TERM.CONNE:2 WIRE VIOLET	00779	530153-7
-74	----- -----			1	CKT BOARD ASSY:GEN LOCK(SEE A5 EPL)		
					(ATTACHING PARTS)		
-75	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
					- - - * - - -		
	----- -----			-	. CKT BOARD ASSY INCLUDES:		
-76	131-0566-00			2	. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000C	L-2007-1
	131-0589-00			23	. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00			3	. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-77	136-0220-00			77	. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
	136-0234-00			2	. CONTACT,ELEC:0.088 OD X 0.247 INCH L	00779	380598-1
-78	135-0260-02			1	. SOCKET,PLUG-IN:16 CONTACT,LOW CLEARANCE	01295	C931602
	136-0269-02			1	. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-79	214-0579-00			15	. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-80	337-1417-00			1	. SHLD,ELECTRICAL:0.55 SQ X 0.685 INCH HIGH	80009	337-1417-00
-81	352-0096-00			1	. CLIP,SPR,TNSN:CRYSTAL	80009	352-0096-00
	131-0993-06			1	. LINK,TERM.CONNE:2 WIRE BLUE	00779	530153-6

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-82	----- -----			1		CKT BOARD ASSY:POWER SUPPLY(SEE A12 EPL)		
						(ATTACHING PARTS)		
-83	211-0116-00			2		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
						- - - * - - -		
-84	131-0589-00			57		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-85	136-0220-00			12		. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-86	214-0579-00			4		. TERM.,TEST PT:0.40 INCH LONG	80009	214-0579-00
-87	----- -----			1		CKT BOARD ASSY:RELAY(SEE A13 EPL)		
-88	131-0589-00			8		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-89	136-0252-04			8		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-90	----- -----			1		CKT BOARD ASSY:EXTERNAL DRIVE(SEE A11 EPL)		
						(ATTACHING PARTS)		
-91	211-0116-00			2		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
-92	210-1014-00			1		WASHER,NONMETAL:0.094 ID X 0.312" OD,TEFLON	80009	210-1014-00
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-93	131-0589-00			16		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-94	136-0220-00			6		. SOCKET,PLUG-IN:3 PIN	71785	133-23-11-034
-95	136-0252-04			4		. CONTACT,ELEC:0.188 INCH LONG	22526	75060
-96	----- -----			1		CKT BOARD ASSY:BRUCH SEQUENCE(SEE A15 EPL)		
						(ATTACHING PARTS)		
-97	211-0116-00			1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-98	131-0589-00			2		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-99	136-0263-04			12		. CONTACT,ELEC:FOR 0.025 INCH SQUARE PIN	22526	75377-001
-100	136-0269-02			2		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
-101	200-0762-00			1		COV ASSY,LINE V:WITH FUSEHOLDER,115/230V	80009	200-0762-00
-102	352-0102-00			2		. FUSEHOLDER:0.262"ID TUBE FOR CRTG FUSE	80009	352-0102-00
-103	213-0088-00			2		. SCR,TPG,THD CTG:4-24 X 0.25 INCH,PNH STL	83385	OBD
-104	204-0279-00			1		BODY ASSY,LINE:115/230 VOLTS	80009	204-0279-00
						(ATTACHING PARTS)		
-105	210-0407-00			2		NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-106	210-0006-00			2		WASHER,LOCK:INTL,0.146 ID X 0.283"OD,STL	78189	1206-00-00-0541C
						- - - * - - -		
-107	131-0325-00			1		CONNECTOR,PLUG,:MALE,24 PIN	71785	57-30240(398)
-108	131-0324-00			1		CONNECTOR,RCPT,:24 PIN,FEMALE	71785	57-40240(398)
						(ATTACHING PARTS)		
-109	211-0062-00			2		SCREW,MACHINE:2-56 X 0.312 INCH,RDH STL	83385	OBD
-110	210-0001-00			1		WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
-111	210-0201-00			1		TERMINAL,LUG:SE #4	78189	2104-04-00-2520N
-112	210-0405-00			2		NUT,PLAIN,HEX.:2-56 X 0.188 INCH,BRS	73743	2X12157-402
						- - - * - - -		
-113	----- -----			1		LINE FILTER:(SEE FL9201 EPL)		
						(ATTACHING PARTS)		
-114	211-0507-00			2		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-115	210-0457-00			2		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
-116	131-0126-00			18		CONNECTOR,RCPT,:BNC,FEMALE	95712	9663-INT34
						(ATTACHING PARTS FOR EACH)		
-117	210-0241-00			1		TERMINAL,LUG:0.515 ID X 0.625 INCH OD SE	80009	210-0241-00
						- - - * - - -		
-118	----- -----			3		TRANSISTOR:(SEE Q9035,Q9055,Q9085 EPL)		
						(ATTACHING PARTS FOR EACH)		
-119	210-0407-00			1		NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-120	210-0006-00			1		WASHER,LOCK:INTL,0.146 ID X 0.283"OD,STL	78189	1206-00-00-0541C
-121	342-0163-00			1		INSULATOR,PLATE:XSTR,0.675 X 0.625 X 0.001"	80009	342-0163-00
-122	211-0538-00			1		SCREW,MACHINE:6-32 X 0.312"100 DEG,FLH STL	83385	OBD
						- - - *- - -		

FIGURE 2 CHASSIS & REAR (cont)

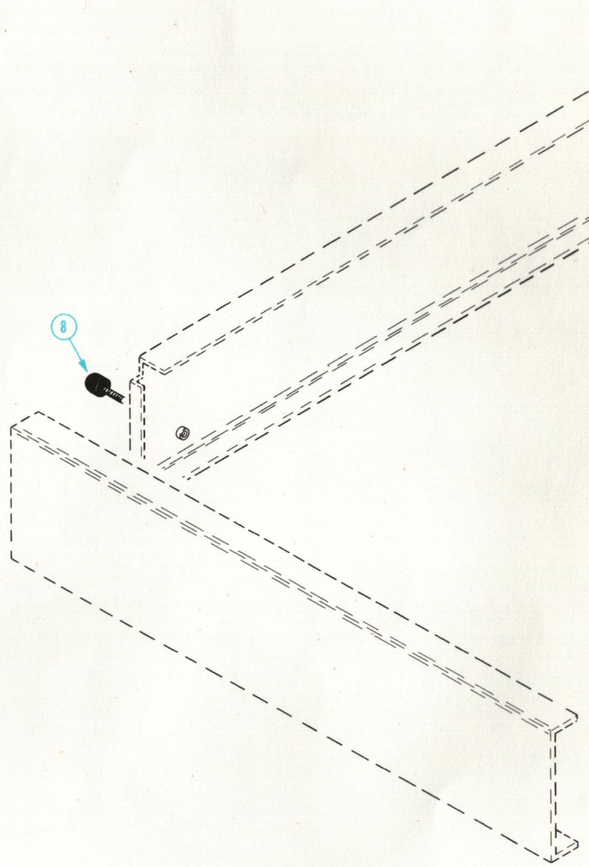
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-123	386-2369-00			1	PANEL,REAR:	80009	386-2369-00
					(ATTACHING PARTS)		
-124	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-125	210-0457-00			4	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-126	344-0133-00			50	CLIP,SPR,TNSN:CIRCUIT BOARD MOUNTING	80009	344-0133-00
					(ATTACHING PARTS FOR EACH)		
-127	213-0138-00			1	SCR,TPG,THD FOR:4-40 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-128	344-0016-00			8	RTNR,CAPACITOR:0.859 ID X 0.937 INCH H	80033	E50007041
					(ATTACHING PARTS FOR EACH)		
-129	211-0007-00			1	SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-130	441-1062-00			1	CHASSIS,SIG GEN:	80009	441-1062-00
					(ATTACHING PARTS)		
-131	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-132	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-133	210-0457-00			2	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-134	386-1487-00			2	BRKT,XFMR SPRT:	80009	386-1487-00
					(ATTACHING PARTS FOR EACH)		
	211-0507-00			2	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	210-0457-00			2	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-135	441-0892-00			1	CHAS,CLR BAR GE:OVEN CKT BD	80009	441-0892-00
					(ATTACHING PARTS)		
-136	211-0504-00			2	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-137	210-0457-00			2	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-138	----- -----			1	TRANSFORMER:(SEE T9001 EPL)		
					(ATTACHING PARTS)		
-139	212-0516-00			4	SCREW,MACHINE:10-32 X 2 INCH,HEX HD STL	77250	OBD
-140	166-0227-00			4	INS SLV,ELEC:0.187 ID X 1.50 INCH LONG	80009	166-0227-00
-141	210-0812-00			4	WASHER,NONMETAL:#10,FIBER	06982	OBD
	220-0410-00			4	NUT,EXTENDED WA:10-32 X 0.375 INCH,STL	83385	OBD
					- - - * - - -		
-142	348-0063-00			4	GROMMET,PLASTIC:0.50 INCH DIA	80009	348-0063-00
-143	348-0064-00			1	GROMMET,PLASTIC:0.625 INCH DIA	80009	348-0064-00
-144	348-0050-00			7	GROMMET,PLASTIC:0.75 INCH DIA	80009	348-0050-00
-145	386-1532-00			1	SUPPORT,CHASSIS:CHAN SHAPE	80009	386-1532-00
					(ATTACHING PARTS)		
-146	210-0457-00			3	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-147	214-1169-00			3	PIN,GUIDE:0.80 INCH LONG	80009	214-1169-00
					- - - * - - -		
-148	214-1621-00			7	PIN,GUIDE:0.74 INCH LONG	80009	214-1621-00
					(ATTACHING PARTS FOR EACH)		
-149	210-0457-00			1	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		
-150	214-1621-00			8	PIN,GUIDE:0.74 INCH LONG	80009	214-1621-00
					(ATTACHING PARTS FOR EACH)		
-151	210-0457-00			1	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
-152	210-0202-00			1	TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
					- - - * - - -		
-153	210-0201-00			7	TERMINAL,LUG:SE #4	78189	2104-04-00-2520N
					(ATTACHING PARTS FOR EACH)		
-154	213-0044-00			1	SCR,TPG,THD FOR:5-32 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-155	255-0334-00			1	PLASTIC CHANNEL:12.75 INCHES LONG	80009	255-0334-00
-156	407-0555-00			1	BRACKET,XFMR:	80009	407-0555-00
					(ATTACHING PARTS)		
-157	211-0507-00			4	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-158	210-0457-00			3	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		

FIGURE 2 CHASSIS & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
2-159	386-2195-00			2	SUPPORT,CHASSIS: (ATTACHING PARTS FOR EACH)	80009	386-2195-00
-160	211-0504-00			1	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-164	441-1050-00			1	CHASSIS,SIG GEN:MAIN	80009	441-1050-00
-162	179-2273-00			1	WIRING HARNESS:MAIN	80009	179-2273-00
	131-0627-00			254	. CONTACT,ELEC:GOLD CLAD,90 DEG	80009	131-0627-00
-163	131-0621-00			49	. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	46231
	131-0792-00			36	. CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
	131-0707-00			119	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	131-0708-00			7	. CONTACT,ELEC:0.48"L,28-32 AWG WIRE	22526	47437
-164	352-0171-00			1	. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
	352-0171-02			1	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	352-0171-03			3	. CONN BODY,PL,EL:1 WIRE ORANGE	80009	352-0171-03
	352-0171-04			2	. CONN BODY,PL,EL:1 WIRE YELLOW	80009	352-0171-04
-165	352-0169-00			2	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
-166	352-0161-00			3	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
-167	352-0162-00			4	. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
-168	352-0165-00			3	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0165-00
-169	352-0166-00			8	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
-170	352-0167-00			2	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0167-00
-171	352-0168-00			3	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
	352-0198-00			10	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
	352-0199-00			7	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
	352-0200-00			8	. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0200-00
	352-0201-00			4	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
	352-0202-00			1	. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0202-00
	352-0203-00			1	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0203-00
	352-0204-00			9	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0204-00
	352-0205-00			7	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0205-00
	352-0206-00			13	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0206-00
	179-1860-00			1	WIRING HARNESS:COAXIAL	80009	179-1860-00
	131-0621-00			15	. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	46231
	131-0622-00			7	. CONTACT,ELEC:0.577"L,28-32 AWG WIRE	22526	46241
	352-0199-00			2	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
	352-0201-00			1	. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
	179-1861-00			1	WIRING HARNESS:POWER	80009	179-1861-00
	131-0621-00			21	. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	46231
	352-0203-00			2	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0203-00
	352-0205-00			1	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0205-00
	179-2359-00			1	WIRING HARNESS:HORIZONTAL TIMING	80009	179-2359-00
	131-0707-00			125	. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
	352-0165-00			1	. CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0165-00
	352-0166-00			4	. CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
	352-0166-03			3	. CONN BODY,PL,EL:8 WIRE ORANGE	80009	352-0166-03
	352-0167-00			2	. CONN BODY,PL,EL:9 WIRE BLACK	80009	352-0167-00
	352-0168-00			1	. CONN BODY,PL,EL:10 WIRE BLACK	80009	352-0168-00
	352-0169-00			1	. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0171-00			25	. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
	352-0171-01			18	. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-01
	352-0171-02			13	. CONN BODY,PL,EL:1 WIRE RED	80009	352-0171-02
	352-0171-03			6	. CONN BODY,PL,EL:1 WIRE ORANGE	80009	352-0171-03
	179-1864-00			1	WIRING HARNESS:AC	80009	179-1864-00

FIGURE 3 BENCH MODEL

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
3-1	124-0216-00			2	STRIP,TRIM:RIGHT AND LEFT	80009	124-0216-00
					(ATTACHING PARTS FOR EACH)		
-2	212-0068-00			2	SCREW,MACHINE:8-32 X 0.312 INCH,TRH STL	77250	OBD
					- - - * - - -		
	386-1663-00			1	PLATE,HDL MTG:	80009	386-1663-00
					(ATTACHING PARTS)		
-3	212-0068-00			2	SCREW,MACHINE:8-32 X 0.312 INCH,TRH STL	77250	OBD
					- - - * - - -		
	----- -----			-	. PLATE,HANDLE ASSY INCLUDES:		
-4	386-1663-01			1	. PLATE,HDL MTG:	80009	386-1663-01
-5	367-0037-00			1	. HANDLE,LUGGAGE:	12136	OBD
					(ATTACHING PARTS)		
-6	212-0506-00			2	. SCREW,MACHINE:10-32 X 0.375 INCH,FLH STL	83385	OBD
-7	344-0098-00			2	. CLIP,DECORATIVE:	12136	OBD
					- - - * - - -		
-8	348-0048-00			4	FOOT:W/6-32 X 0.350 INCH STUD	80009	348-0048-00
-9	348-0048-00			4	FOOT:W/6-32 X 0.350 INCH STUD	80009	348-0048-00
					(ATTACHING PARTS)		
-10	210-0457-00			8	NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
					- - - * - - -		



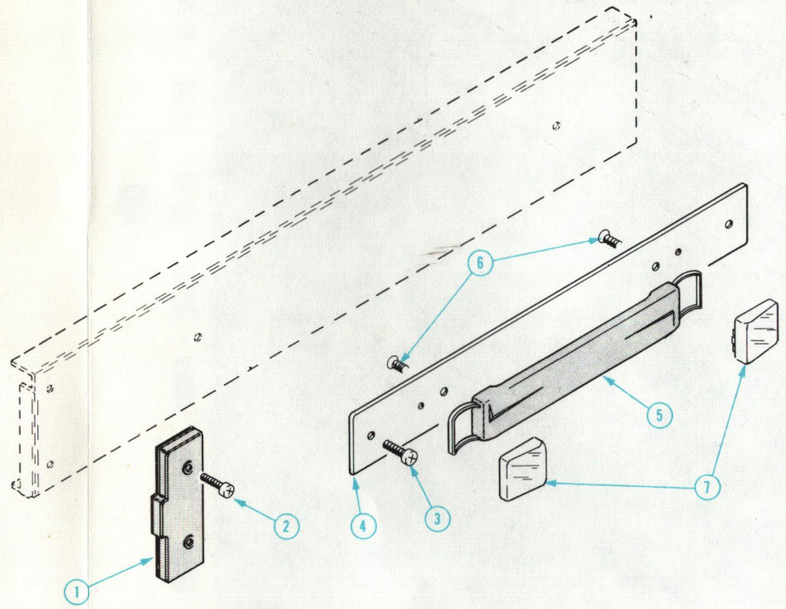


FIG. 3 BENCH MODEL

FIG. 4 ACCESSORIES

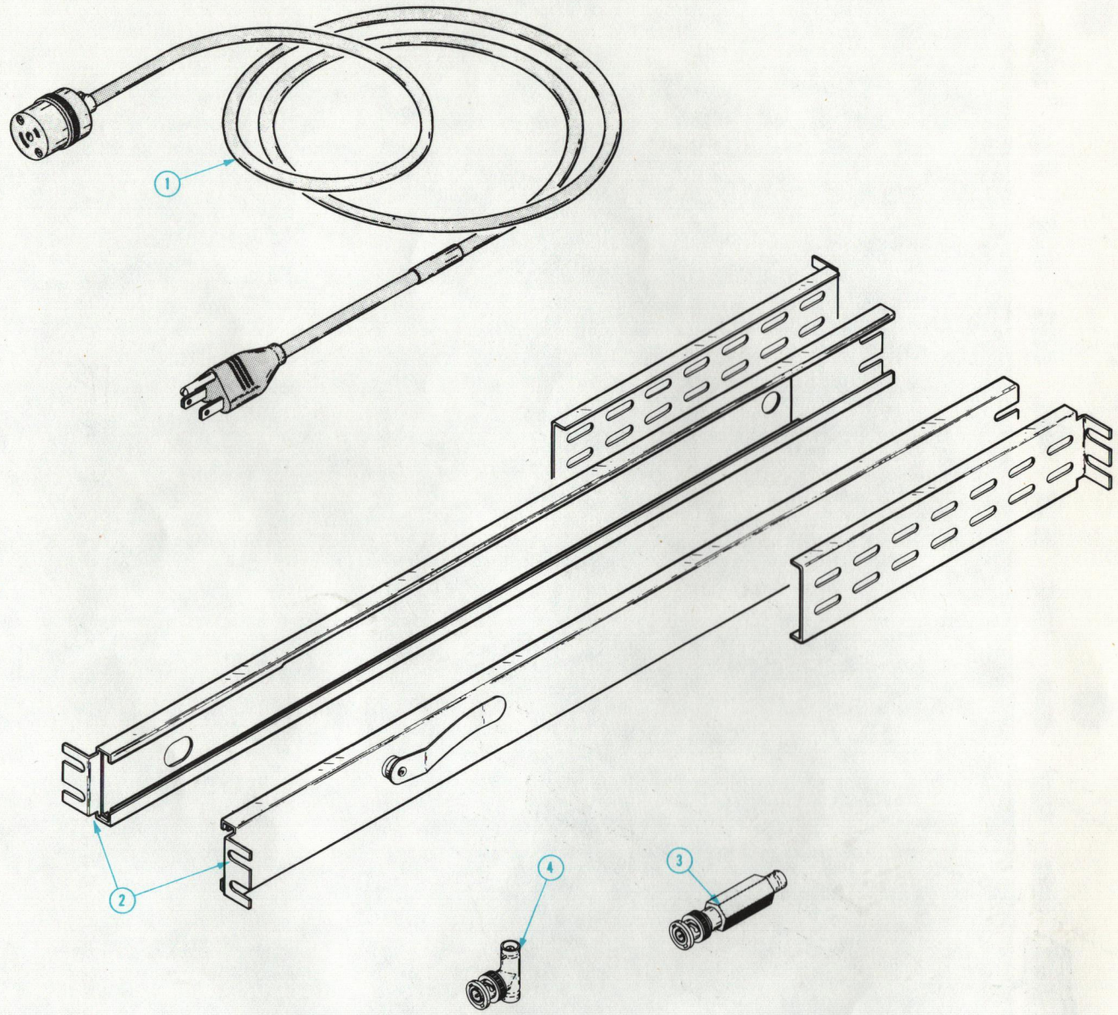


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
4-1	161-0036-00			1		CABLE ASSY:POWER,3 WIRE,7.50 FEET LONG	80009	161-0036-00
-2	351-0195-00			1		SLIDE,DWR,EXT:PAIR(RACKMOUNT ONLY)	06666	C719
-3	011-0103-02			1		TERMINATION:75 OHM,BNC	80009	011-0103-02
-4	103-0030-00			2		ADAPTER,CONN:BNC TO BNC	91737	UG274BUDURAPLATE
	070-1807-00			1		MANUAL,TECH:INSTRUCTION	80009	070-1807-00